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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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USSR REPORT

CYBERNETICS, COMPUTERS AND AUTOMATION TECHNOLOGY

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UDC 621.396.6

KARL-3 SYSTEM FOR AUTOMATED DESIGN OF PRINTED-BOARD CIRCUITS

Kharkov AVTOMATIZIROVANNYYE SISTEMI UPRAVLENIYA I PRIBORY AVTOMATIKI VYPUSK 70 in Russian 1984 (signed to press 4 Sep 84) (manuscript received 25 Nov 82) pp 93-99

[Article by I. G. Vintinzenko, I.G. Malykh and Yu.F. Mirnykh]

[Abstract] Analysis of several computer-aided design systems led to the development at the Tomsk Institute of Automatic Control Systems and Electronics, from 1979 to 1982, of several versions of the compact and efficient KARL design system, which can be used on any YeS computer larger than the YeS-1020 with storage of at least 256 kbytes and MFT 4.1, MVT 4.1 and MVT 6.1 operating systems. The set of program modules is under the control of a monitor program in high-level PL/1 language and can be further developed and enlarged if necessary. There are no limitations on the dimensions of the boards or spacing of locations of elements and positioning on both sides or other circuit factors such as connections. Up to 500 designs can be handled simultaneously. The designer begins with a sketch of the design using groups of elements and the data base supplies necessary information as to elements and factors for further develment while sketches are also printed out. The final output is a completed design. Documentation is also generated as well as punched control tape for photomask fabrication and execution of drilling by numerical control methods for the actual production of the boards. The KARL-3 is oriented towards a batch system of operation while the KARL-3T is preferable for dialogue mode work. The automatic design procedures can be interrupted at any time by the designer for additions or corrections and the various design states and variants can be recalled if necessary. Dynamic memory distribution is used. Many program operations and conditions are not directly accessible to the user during the usual operations but it is possible to change the standard operating conditions or initiate other programs or routines. An original spatial-decomposition system realized in KODOS language is used for the description of electrical circuits. The element positioning problem can be solved by 8 different optimization strategies. Actual use shows that a complete photomask can be supplied for a required problem in 24 hours of working time or 2-3 hours of machine time providing a saving of 300-400 rubles. The KARL-3 system is 8-10 times faster than previous systems and has already been introduced into service. References: 2 Russian.
[404-12497]

UDC 681.32

MODEL OF MULTIPROGRAM OPERATION IN NONHOMOGENEOUS COMPUTER SYSTEM WITH STRICT MEMORY DIVISION

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 3, May-Jun 85 (manuscript received 27 Dec 83, after revision 12 Oct 84) pp 58-64

[Article by V. A. Vishnyakov, and O.V. German]

[Abstract] A computer network combines N nonhomogeneous computers with their own main memory. The system runs a batch of programs represented by a directed graph having a specified set of points and lines, where each point corresponds to a particular program module. Each computer can parallel process the current module and execute data input/output. The computer can start the processing of the next module if certain conditions are met. The control supervisor must plan the order of execution of the modules for each computer so that the generated schedules satisfy a minimum time requirement. The supervisor performs two functions: reduces time losses due to the waiting for the completion of I/O operations to a minimum and reduces time losses occasioned by nonoptimal planning of the graph with unweighted lines to a minimum. Some 20 examples were calculated for N = 2, 3, 4. The time requirement averaged 9.8% more than the optimal figure with the maximum time excess being 27.2%. The optimal result was achieved in 9 cases. The proposed model can be used in setting the supervisory for applied modules in computer scheduling problems. References 8: 7 Russian, 1 Western.
[391-8225]

UDC 681.3.06+681.325.5-181.4

SIMULATION AND ANALYSIS OF CHARACTERISTICS OF DISTRIBUTED MULTIPROCESSOR SYSTEMS

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 3, May-Jun 85 (manuscript received 5 Sep 83, after revision 21 Jun 84) pp 70-75

[Article by E.O. Akhmedov, A.A. Dzhavadov, S.F. Ismaylov and B.G. Ismaylov]

[Abstract] A communications line delivers an input message flow to a supervisory microprocessor that is tied to an interface bus. An arbitrary number of homogeneous peripheral microprocessors and an input/output peripheral are also coupled to the bus. The supervisory microprocessor coordinates the real time operation of the system. It is necessary to assure a minimum loss of information with the minimum requisite system performance. This paper treats the microprocessor system as a single phase queuing configuration and determines the system efficiency in terms of the mean value of the probability of delay losses or losses due to system overloading. Expressions are found for the number of input claims, L_q, awaiting servicing in three cases: for exponential, constant and Erlang servicing time. A graph is drawn for these three cases (assuming a Poisson input flow) using the results of YeS-1022 computer simulation and shows L_q as a function of the number of microprocessors. Figures 5, references: 2 Russian.
[391-8225]

SM-1810 DOMESTIC PERSONAL COMPUTERS AND DIALOG COMPUTER COMPLEX

Moscow NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "RADIOELEKTRONIKA I SVYAZ" No 8, Sep 85 PERSONALNYYE EVM in Russian pp 46-47

[Article by Boris Mikhaylovich Rudzitskiy, candidate of economic sciences, senior scientific associate, and worker in the USSR Academy of Sciences, in "Personal Computers" in the popular science subscription series, "Radioelectronics and Communications."]

[Text] According to the designers' intentions, each type of personal computer should be developed and manufactured as a series of machines differing in the potentialities and nomenclature of external devices and in the capability for application to the solution of problems of various classes and so forth.

The most powerful computer for the dialog computer complex series with developed functional potentialities is the "Elektronika NTs 80-20/3." It represents a highly integrated desk computer. This is basic hardware intended for application in systems of data management and data processing, mathematical modeling and statistical analysis, and to engineering calculations and designing, and also in computer networks with complicated structure.

The machine includes the following: a single-board "Elektronika NTs 80-01D" microcomputer the base, and other personal computers of this series; a video display graphic monitor; a thermal printing device; a keyboard; a floppy disc unit; and a plotter.

Let us describe the basic characteristics of the "Elektronika NTs 80-20/3." The speed of the microprocessors (depending on the type of operation) is from 2,000 to 60,000 operations per second. The volume of main storage is 56 KBytes, and the volume of read-only memory is 8 KBytes. The instruction set is fully compatible with the instruction set of the "Elektronika 60" microcomputer.

The video display monitor is a monochrome CRT with a diagonal of 31 cm. The screen accommodates 24 lines of 80 characters each. It is possible to display both alphanumeric characters and graphic images. To process graphic images, the monitor has an internal storage and, for storing graphic data, there is a screen field measuring 800 x 264 dots.

To carry the text and graphic images from the CRT screen to thermopaper, a thermoprint device is used. The type of printing here is by line, with a speed of 60 characters per second and a print width of 210 mm.

The keyboard is intended for the input of alphanumeric and graphic information; it is divided into four zones. The first contains the letters of the Russian and Latin alphabets, other symbols, and graph elements; the second contains numerical keys and also keys for arithmetic operators and trigonometric functions, and a "print" key; the third contains keys for program control and fulfillment of commands; the fourth contains keys for addressing any of 32 subprograms prepared earlier by the operator.

The floppy disc unit has two-sided recording on discs with a 203 mm diameter. The total volume is 1 Mbyte and the date exchange rate is 50 kbyte/sec.

Interface is also provided for connecting a flatbed plotter and coder, and a programmer for semipermanent memory has ultraviolet erasure.

Other software includes the "Shkolnitsa" dialog system applied in teaching; and the "business" package, which includes a data base management system, graphic and textual editors, and also tabular computer.

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CSO: 1863/40

UDC 658.012.011.56:681.3

CONCEPT OF AUTOMATED MACRODESIGN OF NETWORKS OF AUTOMATED CONTROL SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85 (manuscript received after revision 10 Aug 84) pp 7-11 (ended on 36)

[Article by Yu.Yu. Kess, Scientific Research Institute of Economics and Planning under Gosplan, Lithuanian SSR, Tallin]

[Abstract] Because of the increasing complexity of automated control systems (ASU), automated design systems must be replaced by automated macrodesign systems (SAMP) based on a modular and hierarchical concept of ASU networks. The control metaobject is the hierarchical aggregate of homogeneous design objects (for example, the motor transport equipment of a republic). The ASU and its modular components are synthesized by SAMP man/machine procedures and the designs must not depend on the actual realizations. The artificial intelligence concept of frame is applied to the design of the modules and macroelements are represented and manipulated on design screens with recourse to procedures which have results which cannot be predicted by users and the resulting designs are stored in libraries. Various users can work independently while a chief engineer solves conflicts. The SAMP system is also supposed to automatically produce and update technical documentation but problems have been encountered in the realization. An experimental SAMP was built using the PRIZ interactive development program system which utilizes semantic modules and the UTOPIST problem-oriented language. The metaobject is represented by protoframes which are assigned specific data and subnetworks of "exframes" are formed by macroprocedures. The new object is represented by a frame model of the ASU design. Macroprocedures have a constant part (photoframes, macroprocedures) and a variable part depending upon the control object. The UTOPIST language allows the user to form a personal sublanguage for his part of the system. The PRIZ system automatically synthesizes solution algorithms and programs which can be tested by modeling with real data and then modified if necessary. Automating the design of very large ASU (for example, at republic scale) is important because of the great complexities involved and the difficulties in coordinating the work of the design organizations make it practically impossible by hand. References: 13 Russian.
[324-12497]

UDC 681.3.06

VECTOR COMPUTATION PROGRAM SYSTEM

Moscow PROGRAMMIROVANIYE in Russian 1985, No 4, Jul-Aug 85 (manuscript received 25 Apr 84) pp 25-32

[Article by V.P. Razbegin, G.N. Kalyanov, and B. V. Kupriyanov]

[Abstract] This study describes the VEKTOR procedural programming language, in which programs, procedures, and functions are the fundamental program units. Procedures and functions can be embedded, or can comprise autonomous modules. The language supports arithmetic and logical VECTOR*VECTOR, SCALAR*VECTOR, and VECTOR*SCALAR element operations, convolution over a series of element operations, ANY and ALL quantors for logical vectors, and left and right cyclic shift operators. The VEKTOR programming system is designed to support software complexes for the PS-2000 in high-level VEKTOR language and PPS-2000 microcode, the configuration of program complexes, and linking of SM-2 applications programs with PPS-2000 programs, as well as PPS-2000 programming debugging in terms of the VEKTOR language. The features of the VEKTOR compiler, statistical analyzer, standard microprogram library, SM-2 interaction control program library, and debugger are described. All of the programs making up the programming system comprise approximately 80,000 conventional instructions; the system has been in operation since early 1983, and has increased programming productivity 10-12-fold as compared with programming in lower level languages. References 11: 5 Russian, 6 Western. [12-6900]

UDC 681.3.068

SYSTEM OF AUTOMATED TESTING FOR MIXAL PROGRAMS

Moscow PROGRAMMIROVANIYE in Russian No 3, May-Jun 85 (manuscript received 2 Dec 83) pp 50-58

[Article by V.L. Katkov and G.V. Yermakov]

[Abstract] MIXAL is a component of the MIX system and is used for teaching assembly programming. The principles are presented for the testing (as distinguished from the later debugging procedures) of the programs. In the MIX system testing is carried out in accord with a criterion for workable program transitions and is oriented towards automatic execution. Testing is carried out in batch rather than dialogue mode and the tests are stored in a library for repetitions and consultations. Automated testing is executed by the Avtotest subsystem which is part of the MIX system and the MIXAL program to be tested must be compatible with the Avtotest format. The test procedure begins with the initialization section in which initial data (variables, etc.) are checked and is followed by the assertion section in which results due to ASRT (assert) operators using a higher-level language

than the MIXAL autocode are verified. If there are errors in the MIXAL program, the Avtotest system operators give information on the characteristics of the faulty operation and their location in the program procedure. The Avtotest subsystem consists of a control program, programs for processing control operators and accessing data in MIX storage for initialization data, programs for searching for MIXAL programs in libraries and programs for processing assertion results which check program syntax. References: 4 Western.
[414-12497]

UDC 681.3.06

TRACING AND ANALYSIS OF COMPUTER SYSTEMS BY MEANS OF THE STAN PROGRAM

Moscow PROGRAMMIROVANIYE in Russian No 3, May-Jun 85 (manuscript received 5 Mar 84) pp 25-37

[Article by Ya.A. Kogan and L.B. Kozinskiy]

[Abstract] Monitors are used to evaluate loading of resources, system settings, and program performance, but system events for the three functions occur at different frequencies and this creates problems for the monitor whose operations may have a negative effect on computer operations. A tracing and analysis sytem (STAN) was developed at the Institute of Control Problems for monitoring YeS computers involving mainly synchronous measurements but with some asynchronous operations. The system consists of tracing and analysis generators. The tracing generator performs interrupts for system monitoring and carries out priority commands and is an improvement on previous monitors since it can cover a broader spectrum of event frequencies. The special feature of STAN is that the control point values, which were set by the user in the operating system, can be monitored. In addition to the synchronous operations there is an asynchronous part operating in problem mode by means of a timer which carries out dialogue exchange with the user and outputs buffer storage data into peripherals when set off by certain factors affecting operation of the synchronous part depending upon the rate of event flows. A peripheral unit simulator program can be plugged into the monitor for evaluation of the work load in interactive mode. The analysis generator produces programs for sampling readings and printing output and contains statistical processing programs while the user can introduce additional programs for dealing with particular events and situations. The system produces indicators for resource loading, task service time characteristics, the number of tasks using virtual memory resources, statistics for direct access data resources and for use of library data and programs in the fixed part of the main memory, for frequency and times for main system tasks and for use of priority operations as well as addresses for tracings of executed programs. There are no special requirements for the use of STAN, which can be used with the 4.1 YeS operating system or improved versions. Results are given for the application of STAN for three computer systems with different degrees of multiprogramming (M-4030 and YeS-1045 computers) and experimental applications

are considered for raising productivity and studying the behavior of programming whose effectiveness is linked to the relative proximity in space and time in various forms of memory of data required by program commands. Inefficiency increases as the degree of multiprogramming rises. References: 3 Russian, 5 Western.
[414-12497]

UDC 681.3.001

ON THE THEORY OF OVERALL STORAGE ECONOMY

Moscow PROGRAMMIROVANIYE in Russian No 3, May-Jun 85 (manuscript received 11 July 83) pp 82-85

[Article by N.A. Vasilyev]

[Abstract] Overall storage economy was treated by a theory linking memory economy and the coloring of the nodes of a graph for equal weighted statistical variables (scalars) for the class of closed operational circuits and standard circuits and which involves ordered colorings for these variables and the construction of memory distribution axiomatics (Lavrov-Yershov theory). For a given program there is a standard circuit consisting of a transition graph whose nodes are operators and the branches determine the transition of control from one operator to another between which are information links in which results from one operator become the argument of another. Correct memory distribution implies that there will be a single value for results and arguments in each data link. Data link routing requires transmission of a value along a single link and leads to the formation of a data graph whose edges and nodes can be treated as a coloring problem determining optimal ordering of the data organization for the initial program. It is proposed to extend this concept to the case of data groups considered as vectors which have weights greater than the scalars and are oriented with respect to memory addresses in a forward or backward direction (from earlier to later addresses or the reverse). This makes it possible to introduce into the memory circuit design the concept of partial or complete generation for data groups with various weights leading to expressions for optimal data ordering and addressing in the memory. References: 10 Russian, 1 Western.
[414-12497]

UDC 681.3.06

GRAPH-TEXT CODING OF ALGORITHMS

Moscow PROGRAMMIROVANIYE in Russian No 3, May-Jun 85 (manuscript received 3 Jan 84) pp 14-24

[Article by V.A. Zhizhko]

[Abstract] Clarity of representation is an important factor in increasing programming efficiency and reducing costs and, in the process of creating programs, graphic procedures, modules, formats and mnemonics are used to develop flowchart representations of the algorithm. The problem considered is the improvement of the transformation of the two-dimensional graphic scheme into the linear sequence of symbols constituting the textual representation of the algorithm. The transformation (or coding) of the flowchart into the text is a routine process which does not require high qualifications and tends to be automated. An R-code procedure is available which produces structures isomorphic to the flowchart and uses a special translation language (R/TRAN). The usual computer symbols are used to reproduce the flowchart shapes by running together strings of characters resembling graph forms. The paper proposes an improvement (S-code) of the method with a more detailed breakdown of graph forms for reproduction by computer characters. The result is an S-graph which is translated into the object language (whether of FORTRAN or ALGOL types) by a program run in a preprocessor based on the node and edge structure of the graph. Certain problems in the establishment of the S-graphs are due to limits on the possible line dimensions of the computer input which are dealt with by special constructions or sub-graphs. The S-code metalanguage is represented in Backus-Naur notation with certain symbols added. The procedure constitutes an effective universal algorithmic language which can be used with the current object languages. The code program was realized with 14 kbyte storage on a BESM-6 preprocessor for ALGOL-GDR and the time necessary for the translation of the S-code was less than that required by the object program translator. The method is compatible with LISA equipment and Macintosh Apple technology. References: 8 Russian.
[414-12497]

UDC 681.3.06+681.32

DEVELOPMENT OF DIALOGUE MODE MICROCOMPUTER PROGRAMMING USING YeS COMPUTERS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85 (manuscript received after revision 10 Aug 84) pp 34-36

[Article by A.A. Ilyukovich and V. Yu. Bobolovich, Belorussian Affiliate of the All-Union State Design and Engineering Institute of the Central Statistical Administration, Minsk]

[Abstract] Microcomputers are increasingly used in integrated automated control systems and in processing networks, resulting in additional program needs.

However, problems arise because of the small memories, limited operating systems and insufficient peripherals of the microcomputers in comparison with YeS computer resources. A cross-system utilizing large computer programs for preparing programs for the Elektronika-60 and other mini- and microcomputers of this architecture was developed at the Belorussian Affiliate of the All-Union State Design and Engineering Institute for Computation Mechanization of the USSR Central Statistical Administration. It operates on the YeS computer with a version 6.1 YeS operating system. The cross-system consists of a cross-translator and assembler, linkage editor, data set converter program, debugger and dialogue mode control program. The generated operating system has a telecommunication access component. Programs can be prepared in dialogue mode on YeS 7920 displays by eight users simultaneously on a time sharing basis. System operators and procedures are described. Experience showed that the YeS computer was most effectively used if there were six-eight simultaneous users. Two tables, one figure, references: 2 Russian.
[324-12497]

UDC 681.3.016

ORGANIZATION OF A SINGLE SHARED EXTERNAL MEMORY FOR AUTOMATED DESIGN SYSTEM

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85
(manuscript received after revision 27 Nov 84) pp 42-46

[Article by S.N. Grishchenko, A.O. Ulybin and V.A. Finikov, Leningrad]

[Abstract] Experience with automated design systems requiring large storage volumes using individual external memories (tapes, discs) shows that the number of memory units increases continuously while the devices remain only 40-50% full. A shared memory system is described for the BESM-6 computer involving dynamic distribution among users of memory space on tapes and discs with access to storage only through the system. The shared memory consists of system and user space with system space making up only .4% of the volume. Users are divided into groups and each group is dynamically assigned a certain space for a task in a manner compatible with the Dubna operating system. Spaces can be moved and regrouped. Procedures for control and optimization of space use are described. The system was realized in the form of 296 modules in MADLEN autocode in FORTRAN-GDR with a volume of about 60,000 BESM-6 commands. There must be a resident store. When the system is set up it is possible to set the main parameters, i.e., maximum number of tasks which can be handled simultaneously; maximum number of spaces available to user; maximum number of magnetic tapes or discs which can be accessed simultaneously. The monitor program occupies 52 storage cells. The system space has permanent and temporary statistical and dynamic tables which are constructed with sequential, index-sequential, direct, tree, list and stack organizations. The system was used in the SIMPRO computerized design system with the PIO file system. 2 Figures, References: 4 Russian, 2 Western.
[344-12497]

UDC 681.3.069

RIS SYSTEM FOR COMPUTER-AIDED PREPARATION OF GRAPHIC DOCUMENTATION

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85 (manuscript received 14 May 84) pp 74-77

[Article by V.L. Katkov, G.Ye. Khlebtsevich, A.I. Bliznets, NIIEVM, Minsk]

[Abstract] The RIS system was developed for handling and introducing graphic material into computerized text editing. When the automated Strela text system encounters a graph the RIS system takes over and editing is possible from alpha-numeric keyboards. It utilizes primitives for composing the graphs and is largely independent of the type of computer used. RIS is oriented towards non-professional users and has a language close to natural Russian with word variations possible as to gender, number and case. Both text and graphs are in the form of alphanumeric sequences and both types of material can be handled simultaneously in batch or dialogue mode on standard displays. RIS was realized on YeS computers using SIPL-1 translator language and with OS YeS and PDO SVM YeS operating systems. After completion the RIS file is translated into a FORTRAN language GRAFOR graphic program or into a Calcomp magnetic tape file for the actual graphics output generation greater portability. References: 4 Russian, 3 Western.
[344-12497]

UDC 658.5

AUTOMATED DESIGN OF PROGRAMS FOR DATA BASE MANAGEMENT IN TELEPROCESSING MODE

Kharkov AVTOMATIZIROVANNYYE SISTEMY UPRAVLENIYA I PRIBORY AVTOMATIKI VYPUSK 70 in Russian 1984 (signed to press 4 Sep 84) (manuscript received 24 Nov 82) pp 60-64

[Article by Yu.B. Sytina, L.A. Gendelman and I.A. Saprykina]

[Abstract] A data teleprocessing system was developed at the Ulyanovsk computer center in 1981 for YeS-7920 terminal data representation equipment consisting of a set of application programs each using the KAMA control system with time sharing. Each system carries out a function and tasks by means of the KAMA system which does not, however, have the necessary command functions which are supplied by the application programs. By means of a standard application package, standard facilities were created for the handling of data files including screen functions, query formats, data distribution on screen, dialogue facilities and the file processing algorithm, making it possible to automate application operations for the processing of sequential and index-sequential files and for realizing data input, searching and scanning, and correction. The program generation part of the package has a set of programs for generating programs for file processing and a group containing function generators implementing data handling. Each generator has a

starting module into which the user loads data using assembly language with later translation and editing. The reason for the creation of the separate programs for various functions is that the KAMA system cannot productively handle programming requiring large data volumes. The program operating system consists, firstly, of the KAMA system; secondly, of the generated program which takes over control for its particular task and; thirdly, of auxiliary programs for handling data on the screen. There is a convenient user language for program generation and operation and easy introduction of parameters or requests. The YeS 6.1 MVT operating system is used and the computer configuration should have a capacity of more than 512 KBytes in order to handle the system which has telecommunication access facilities. [404-12497]

UDC 658.516:025.4

THE DEVELOPMENT OF AN IDENTIFIER SYSTEM FOR ELEMENTS OF A PRODUCTION SYSTEM ON THE SCALE OF AN ENTERPRISE

Moscow KLASSIFIKATORY I DOKUMENTY in Russian No 7, Jul 85 pp 25-29

[Article by V. Ya. Sedush, G. V. Sopilkin, N.A. Chentsov, and V.I. Isayenko (Donets Polytechnical Institute)]

[Text] A technological system in an enterprise is a complex of mechanical, electrical, electronic and other equipment. The contemporary trend towards improving equipment requires solving a different set of problem for each component in the technological system, all the way down to a nut or bolt. Therefore, devising codes for all equipment parts is necessary.

In connection with the requirements of the equipment maintenance tasks, a coding system for identifying the parts in a technological system of an enterprise was designed at the Donets Polytechnical Institute. This method reflects the structure of the technological system and creates possibilities for using a subset (incomplete) of the code for solving tasks by lower level maintenance personnel.

A technological system of an enterprise has six levels:

1 Technological system proper-S (blooming mills, power system);
2 Subsystem of the technological system-P (mechanical, electrical);
3 Machine-M (an element of the subsystem, shearing machine and distribution device of 3 kilovolt);
4 Unit-U (a part of the machine crank, tire);
5 Part-D (bearing, insulator);
6 Hardware-fasteners-Ye (key, bolt).

The complete nomenclature for the technological system consists of a code for every element at each level in the hierarchy. By an identifying code, the location of an element in the technological system can be defined.

In order to determine the length of the codes for the equipment components, an analysis of their attributes was conducted at each level of the hierarchy.

The formulation of the codes for the technological systems were derived from their locations in the structure of the enterprise. As an example, an analysis of the structure of a metallurgical complex was conducted in regards to the nature of its physical layout. The following series of codes for the technological system was determined:

01-19	sintering shops
20-39	blast furnace shops
40-59	steel melting shops
60-79	rolling shops
80-99	finishing of rolled stock shops

The codes for the subsystems within the technological system were determined by an analysis of equipment using three traits. Three types of equipment were noted by their position in the technological system:

directly utilized in the technological process (technological);

providing for increased term of service of the equipment (provision);

utilized during equipment overhaul (repair).

The equipment was divided according to physical states of matter used in energy transference. They were are follows:

mechanical (solid)

hydraulic (liquid)

pneumatic (gas

electrical (plasma)

The equipment was divided by its function as follows:

Acting on raw material in the process of their transformation into finished products (power)

Utilized for control of power equipment (control).

Consequently, a technological system can be divided into 24 (3 x 4 x 2) subsystems. The analysis of the actual technological system showed that it was better to join together the technological and repair equipment into one group. Then their classification was determined by their energy utilization. The control mechanism category was designated as a fourth subsystem depending on the type of energy used.

Thus, the most widespread enterprise technological system is divided into the following subsystems:

Power and repair equipment:

mechanical
hydraulic
pneumatic
electrical

Provision equipment

Control equipment

mechanical
hydraulic
pneumatic
electric

A single-digit numerical code can be used considering the above subsystems.

While describing real technological systems, subsystems are frequently united and this unification allows for a smaller number of them. For example, a mechanical power system is logically united with the mechanical control subsystem. The criteria for subsystem unification could be: size of the subsystem, methods of maintenance, and others.

The principles for the formulation of codes for machines, components, and parts are described in the work [1]. The term "machine" designates subsystem elements which can function independently, e.g. a press and machine tool. They are given a three digit code (001-999). The term, "unit" designates a group of elements (parts) that are joined together in order to fulfill a certain function. For example, a drive shaft unit includes these parts: shaft, gear, bearing, key, etc. These units are coded by two digits (01-09)

Analogously, parts are coded (01-99). An analysis of the concept "parts" is found in the reference (1). It divides parts into simple and complex ones. Parts which include hardware are arbitrarily called complex. For example, a complex part "bearing cover" could include the bolts, nuts, and washers by which it is attached. Hardware is not included in simple parts. An example of a simple part is a bearing. Complex parts are designated by a three digit code from 010 to 024 and simple parts from 025-099. An analysis of hardware characteristics led to a one digit code from 1 to 9. The coding of hardware is as follows: to the code of the complex part a number is attached at the far right as a designation which characterizes hardware. The zero, at which the code of the complex part begins, is cleaned up. For example: 102 for a nut and 125 for a splint. The chosen system for coding parts and hardware leads to a simplification of the procedures of chopping down the code system downwards, applicable to certain equipment maintenance tasks, which allows the quantity of information which is written on machine carriers to be reduced, at the same increasing the degree of its use.

Thus, the elementscode system of a technological system appears as follows: XX X XXX XX XXX

- XXX — Parts & Hardware Code (D, Ye)
- XX — Unit Code (U)
- XXX — Machine Code (M)
- X — Subsystem Code (D)
- XX — System Code (S)

For solving a number of problems, partial codes such as XXX XX XX (cut at the top) or XXX XX XX (cut at top and bottom) could be used. The maximum reduction of the code was used for equipment maintenance by the repair brigade.

For mechanical equipment, the codes for elements and their names were unified.

Codes for units: 10 - motor clutch; 11 - drive shaft; 12- second shaft; 13 - third shaft; 14 - fourth shaft; 15 -gear housing; 16 -clutch unit; 19 - brake; 20 - mounting.

Codes for parts: 100 - shaft, 011 - gear, screw; 012 - ring gear; 013 - bearing from the drive side; 014 - bearing from the idle side; 015 - bearing housing from the drive side; 016 - bearing housing from the idle side; 017 - bearing cover from the drive side; 018 - bearing cover from the idle side; 019 - seal for the drive side; 020 - seal for the idle side.

The hardware codes are as follows: 0 - nonexistent; 1 - shaft with outside threads (bolts, rods, etc.); 2 - ring with inside threads (nut); 3 - washer regular; 4 - washer special; 5 - element for preventing the twisting of a nut from a bolt (splint); 6 - element for preventing the turning of a complex part (key); 7 - element for preventing the axial twisting of a complex part (ring); 8, 9 - extra.

For a complete description of the technological syste, a table of connections is used in which connectible pairs of components from different subsystems are shown.

The described principles for coding the elements in a technological system of an enterprise makes it possible, in addition to assigning names to the equipment parts in the system, to describe the structure of the technological system, provide a classification of elements in the technological system, and make possible the partial reduction of the code required in solving problems in the maintenance of equipment.

The described nomenclature method for identifying the elements in a technological system was used by ASU "Remont" at the Oskol Electrometallurgical Enterprise.

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12761/9835
CSO: 1863/446

PROGRAMMABLE HAND CALCULATORS IN AVIATION SPORTS

Moscow KRYLYA RODINY in Russian No 7, Jul 85 pp 15-16

[Article by A. Romanyuk, republic category judge: "Microcomputer or programmable hand calculator? Experience in applying a programmable hand calculator in judging glider competitions"]

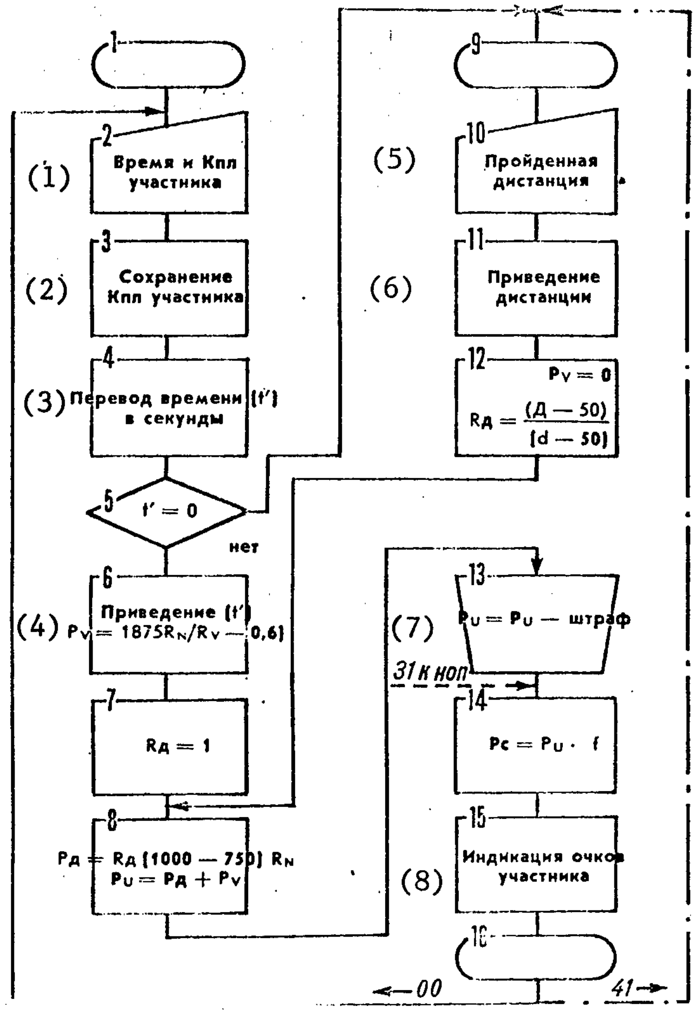
[Text] Yu. Tarasov's article "Effectively, precisely...", published in this journal (No 3, 1984) suggested the use of the Elektronika-60 microcomputer with a complex of peripheral devices in judging aviation sport competitions. The advantages of this solution to the problem are inarguable and were examined in detail by that author. Unfortunately, the cost of this class of computer hardware (10-15 thousand rubles), the remoteness of the meets from computer centers, and the lack of trained personnel and computer applications experience comprise major difficulties.

I propose that the MK-54 programmable hand calculator be used as a computer that calculates the points of participants in glider competitions. The cost of this and similar calculators (MK-56, BZ-34) varies between 50 and 100 rubles. The calculators feature a simple programming system, are easy to use and can muster most of the computational power required. I have developed and tested a program for the mentioned hand calculators. It can execute point calculations in different glider class competitions when draws occur both in speed and distance competitions for any combination of finishers. The set-up time to run the calculations is less than 5 minutes, and the time required to calculate the results of one participant is less than 12 seconds. The program has been used in judging competitions in league 1 of the Ukrainian SSR and in oblast competitions. A simplified flow chart of the algorithm used is presented, and a chart of the addressed registers is given in table 1.

Table 1

Address of register	Value	Comment	Sample input
a	1000-750 x R_N		625
b	1875 x R_N		937.5
c	reduced winning time in seconds		8237
d	measured distance in km		155
1	day factor		0.6
2	0.6	a constant	
3	3600	a constant	3600
4	60	a constant	60
5	50	a constant	50
6	C_{MAX} of finisher	a constant	0.93
7	P_V	input 0	0
9	00 or 41	in dependence on the adjustment	00
0	glider coefficient of participant	used provisionally, program-loaded	
8	any value	reserve	

Simplified flow chart of a program that computes glider competition participant points.



Key:

1. Time and glider coefficient of participant
2. Storage of participant glider coefficient
3. Conversion of time into seconds
4. Reduction
5. Traversed distance
6. Reduction of distance
7. $P_U = P_U$-penalty
8. Display of participant points

Table 2 presents the text of the program.

Table 2.

(1) Адрес	(2) Код	(3) Команда	Адрес	Код	Команда
00	40	ХП 0	25	47	ХП 7
01	25	F⟳	26	01	1
02	14	↔	27	6—	ПХ А
03	64	ПХ 4	28	12	x
04	12	x	29	67	ПХ 7
05	10	+	30	10	+
06	14	↔	31	50	с/п
07	63	ПХ 3	32	61	ПХ 1
08	12	x	33	12	x
09	10	+	34	00	00
10	57	Fx≠0	35	47	ХП 7
11	39	39	36	14	↔
12	60	ПХ 0	37	50	с/п
13	66	ПХ 6	38	89	К БП 9
14	13	÷	39	50	с/п
15	13	÷	40	60	ПХ 0
16	6[	ПХ С	41	66	ПХ 6
17	14	↔	42	13	÷
18	13	÷	43	12	x
19	62	ПХ 2	44	65	ПХ 5
20	11	—	45	11	—
21	59	Fx⩾0	46	6Г	ПХ д
22	26	26	47	65	ПХ 5
23	6L	ПХ В	48	11	—
24	12	x	49	13	÷
			50	51	БП
			51	27	27

Key:
1. Address 2. Code 3. Instruction

Table 3 presents a conventional protocol for an event (155-km triangular course flight), demonstrating the use of the program.

Table 3.

(1) № п/п	(2) Тип планера	(3) Коэфф.	(4) Время	(5) Дистанция	(6) Штраф	(7) Очки
1	ЛАК-10	0.83	2ч04м10с	155 км	10	978
2	ЯНТ. ст. 2	0.92	2ч30м15с	— » —	—	910
3	ЯНТ. ст.	0.93	2ч32м12с	— » —	—	908
4	ЛАК-12	0.82	2ч01м03с	— » —	—	1000
5	ЯНТ. ст.	0.93	3ч48м50с	— » —	—	625
6	К-15	1.00	—	145 км	—	630
7	ЯНТ. ст. 2	0.92	—	120 км	20	389
8	ЯНТ. ст.	0.93	—	150 км	—	595

Key:
1. Number
2. Type of glider
3. Coefficient
4. Time
5. Distance
6. Penalty
7. Points

Preliminary calculations:

The winner is determined according to the time indicated for the distance. The possible candidates are the first and fourth participants. We determine the calculated time for them:

$$t_{1_{red}} = (\text{hrs} \times 3600 + \text{min} \times 60 + \text{sec})/(C_{g1}/C_{fin\ max}) =$$

$$= (2 \times 3600 + 4 \times 60 + 10)/(0.83/0.93) = 8347 \text{ sec},$$

$$t_{4_{red}} = (2 \times 3600 + 1 \times 60 + 3)/(0.82.0.93) = 8237 \text{ sec},$$

which means that the fourth pilot won the competition.

Then we determine the number of pilots with 0.6 of the best speed, i.e., having a calculated time of no more than 1.666... of the winning time:

8237 x 1.66 = 3 hrs 48 min 49 sec.

Four pilots have faster times.

We now determine the ratio of the number of pilots with 0.6 of the best speed to the total number of participants (R_N):

4/8=0.5, then the day factor (f): (2 x 8)/8 - 0.5 = 1.5. We take

this as unity.

We introduced the initial data in Table 1 (sample input) on the basis of calculations. It should be remembered that the calculated winning time is in register c.

Variants of the calculation.

1. Computation of the points of a participant who is a finisher in the speed competition. Input: hours $\boxed{\uparrow}$ minutes $\boxed{\uparrow}$ seconds $\boxed{\uparrow}$ K_{g1} $\boxed{B/O}$,

and after the pause penalty is subtracted: penalty points $\boxed{-}\boxed{B/O}$. After the result is displayed, data for the next participant can be entered.

2. Computation of the points of participants who did not finish the speed competition. Two methods are possible: a. as in the first variant, but where 0 is entered in the hours, minutes and seconds. The program will stop with 0 displayed. This indicates the traversed distance must be

entered: distance $\boxed{B/O}$, and after it stops the second time the penalty is subtracted; b. input: distance, glider coefficient, and after the pause, the penalty.

3. Point calculation in a distance competition draw. The input is similar to that of 2b.

Adjustment of the program for the computational variants.

Variants 1 and 2a do not require change and are ready after the data is entered. The adjustment of variant 2b requires: 41 $\boxed{\text{xп}}$ 9; for variant 3: 41 $\boxed{\text{xп}}$ 9 1000 $\boxed{\text{xп}}$ a.

In addition, if there are no pilots with penalties or a factor equal to 1, then the penalty subtraction pause can be eliminated, having substitued the 31 address command (instead of $\boxed{\text{с/п}}$ use $\boxed{\text{К}}\boxed{\text{НОП}}$).

It must be remembered when working with the hand calculator that the input of the initial data for the next pilot after the penalty subtraction pause is not permissible and will cause unpredictable consequences. In order to restore correct operation of the program, the $\boxed{\text{в/о}}$ key must be pressed in methods 1 and 2a, and the $\boxed{\text{бп}}$ 41 keys in methods 2b and 3.

12678/9835
CSO: 1863/450

COMPUTING CENTER AND CONTINUITY OF PLANNING

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 8, Aug 85 pp 115-116

[Article by V. Andreyev, V. Vasil'yev and V. Smirtyukov]

[Text] The principal objective of a computing center (VTs) and a computing center network (SVTs) is the high-quality processing of information, ensuring its purposefulness, reliability, accuracy, conciseness, timeliness and completeness.

For these purposes relationships describing the state of the environment (customer, accessory component manufacturer, contractor, etc.) are rationally singled out. For the purpose of successful fulfillment of the plan of a production association (PO) or enterprise having an ASUP [automated enterprise management system] or computing center, a forecast is made of the capabilities of internal production, including of the utilization of production capacities, resources and revealed potential, and of the capabilities of the environment (customer, accessory component supplier, coperformer, contractor, etc.). The balance, integration and compatibility of the production structure, environment and relationships between them are taken into account here, as well as the unity of the interests of the national economy, ministries (departments), PO's (enterprises) and their personnel.

The process of developing a working plan for a PO (enterprise) by bringing in computing centers encompasses several basic stages. The first stage includes prospective and norm forecasts. A prospective forecast provisionally continues into the future trends in the development of a phenomenon in the past and at the present. Ways and deadlines for achieving set goals are determined by its means.

The second stage is decision making. This is the problem of choosing in a given situation, which is determined by the following key factors: the goal which must be achieved (or be drawn close to), alternative lines of behavior, and constraints. Alternative lines of behavior can be formed both as a function of internal reasons, and of the influence of the external environment (failure of delivery or incomplete delivery or delivery involving violation of the deadline).

Constraints are subdivided into the following: into economic, associated with resources (labor, physical and financial); technical, directly associated with an engineering analysis and the development of specifications for the technical data of entities (overall size, weight, strength, reliability, precision, timeliness, temperature conditions, and the like); and social, expressing the requirements for the social feasibility of carrying out a specific alternative. The decision made from several alternatives, taking into account the use of forecasting information, marks the way to achieve the goal set. Relations between the production association (enterprise) and customers, accessory component suppliers, contractors, superior agencies, etc., are planned at the same time.

Distribution of the assignments (jobs, etc.) of the plan within a PO (enterprise), SVTs and VTs by performers, as well as by accessory component suppliers and contractors, is accomplished at the third stage. Work is done relating to balancing and integrating the activities of the PO, enterprise, SVTs and VTs with the superior organization and environment with respect to deadlines, quantities and the quality of deliveries of products arriving for processing, and the storage and output of information. Resources (labor, physical, financial, etc.) and reserves (earmarked or found) are distributed by tasks, assignments and jobs, including those to be performed by accessory component contractors.

The compilation and assembly of material for reporting on the results of the completion of plan work, decisions and instructions constitute the content of the fourth stage.

Reporting (work-progress, statistical and accounting) on progress in the fulfillment of plans with an analysis of the situation created is performed at the fifth stage, a forecast is made of the anticipated fulfillment of plans, and suggestions and recommendations are developed for eliminating deviations.

Under conditions of the economic experiment, the problem has been posed of continuous planning in the interrelationship of the operating, current and longterm plans. They must be compatible, integrated and balanced, taking into account operational, tactical and strategic goals and unity of the interests of the national economy, ministries, production associations, enterprises and workers. Thus, continuous planning, encompassing the structure, environment and the relationship between them, has become an urgent necessity.

Taking into account the existence of the required hardware and software at SVTs's and VTs's, as well as PO's and enterprises having or using ASUP's, the solution of this problem is totally realistic. It will make it possible to obtain quickly the necessary high-quality information, both internal (on a PO or enterprise) and from the external environment (from a superior organization, accessory component supplier, coperformer, contractor, etc.), which is to form the basis for the data base for the set period of time.

The solution of management engineering problems relating to producing, processing, storing and outputing the required high-grade information is extremely necessary in conducting the economic experiment. With the presence

of automated control systems (ASU's) and a considerable number of SVTs's and VTs's in the national economy (often not utilized to the full degree), the performance of this task does not represent a very complicated problem. The active participation of SVTs's and VTs's in the economic experiment will make it possible to utilize resources and discovered potential with mobility and flexibility for the purpose of fulfilling plans and for the immediate elimination of possible deviations from them.

Under these conditions it is advisable to deliver to production associations and enterprises control figures and economic norms one year prior to the start of a five-year plan period for the purpose of carrying out the principal stages (first and second) and working it out year by year. In working out a plan for a year, by quarters, it is necessary that the deadlines for approving the plan be set for the beginning of the month of June of the year preceding the year being planned, since requisitions for resources are formed in the early spring and time is required for balancing and integrating worked-out (refined) production plans. By the same deadline the computing centers of associations and enterprises must have refined data for the planned period, including for drawing up the next current and operating plans. These data are refined in the course of the fulfillment of plans.

In our opinion, additional measures relating to expanding the rights of production associations and enterprises in planning and economic management, and for strengthening their responsibility, should include offering them the ability to have mutual access to base data (the portion concerning them), stage by stage (as necessary) and in any sequence of the five-year plan period year by year, yearly by quarter, quarterly by month and monthly by 10-day period (week), as well as on product readiness (percentage or number of and names of unfinished articles), which is necessary for a plan forecast (first stage) and subsequent stages. The quality of the development of plans and, in the final analysis, their fulfillment, depend on the existence of such advance information. Besides, the mutual exchange of data creates good prerequisites for the processing of information which mediates economic relations. If their increasing trend is taken into account, then the development of ASU's [automated control systems] horizontally and vertically must outstrip the development of the national economy by a five-year period as a minimum, for the purpose of developing and refining all kinds of plans (longterm--current--operating) at various levels, in order to take into account their balancing and integration.

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CSO: 1863/4

UDC 65:658.512.6.011.56

FLEXIBLE PRODUCTION SYSTEMS AND THE DEVELOPMENT OF METHODS FOR THEIR CONTROL

Moscow STANDARTY I KACHESTVO in Russian No 8, Aug 85 pp 18-21

[Article by A. M. Voychinskiy, candidate of economic sciences: "Flexible Production Systems and the Development of Methods for Their Control"]

[Text] With the flexibility and growing changes inherent in automated production, the control of present-day production is becoming more complicated, and there is more need for adaptive control systems. This complexity is also connected with constant changes in the following:

planning assignments and a production program's output lists and volume, when an enterprise's capacity is expanded or decreased; there is a tendency in many enterprises to convert from mass and large-scale production to small-scale and even single-lot production;

service personnel involved in the process of tooling-up for production and involved in production itself;

the quantity, quality and orientation of equipment used in automated production (one piece of equipment breaks down, another is reinstalled after being overhauled, more efficient machines, industrial robots and manipulators, and others are installed).

The creation of flexible production systems (GPS) makes it possible to successfully perform the task of increasing the efficiency of social production, when the entire chain of processes, from product design by means of CAD systems (SAPR) and automated systems for production engineering (ASTPP), to the control of the industrial process by means of ASUTP, to the control of production as a whole by means of ASU, as shown in figure 1, is linked into an integrated system.

The successful operation of flexible production systems called for a corresponding organization of production. In particular, greater demands are placed on technological services involving the tooling-up of production: it is essential to organize long-term and daily planning and the assembling of equipment and raw material reserves so as to optimize the load on high-efficiency equipment with minimal expenditures and to ensure return.[1]

Схема 1

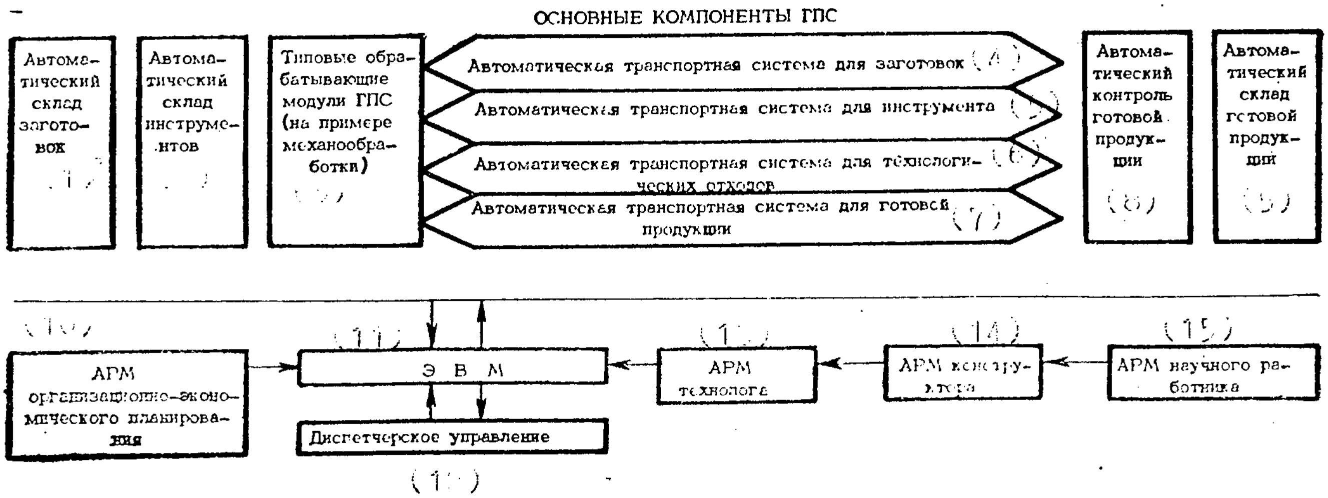

Figure 1. Basic Components of a Flexible Production System

Key:
- (1) Automated storage for blanks
- (2) Automated storage for instruments
- (3) Standard flexible production system processing modules (using machining as an example)
- (4) Automated transport system for blanks
- (5) Automated transport system for instruments
- (6) Automated transport system for manufacturing waste
- (7) Automated transport system for finished products
- (8) Automated testing of finished products
- (9) Automated storage of finished products
- (10) Automated work stations for organizational and economic planning
- (11) Computer
- (12) Supervisory control
- (13) Automated work stations for product engineer
- (14) Automated work stations for designer
- (15) Automated work stations for scientific worker

The rational linking and mutual organizational coordination of all the system components (SAPR, ASTPP, ASUTP, GPS) require the development of industrial control within the existing structure of industrial enterprise control systems, as well as the development of industrial production personnel (PPP). The control of automated production is accomplished with a four-level control system:

the first (based on microprocessor equipment) controls each machine position, industrial robot, intermediate operational storage, and the sequence and nature of operations in order to attain the specified component form, dimensions and quality;

the second (based on the "Elektronika-80" microcomputer) controls a multifunctional robot configuration (RIK) or group of single-function automata along with their attendent storage and transport robots (a robotized area);

in addition to the processing cycle, the loading and unloading of semi-finished materials and finished products are automated, along with waste disposal (for example, cuttings) and the feeding and changing of tools;

the third (based on the SM-4) controls production, a configuration that includes measurement, testing, and diagnostics in the course of the manufacturing process, which makes it possible in the course of one or two shifts to operate multifunctional robot configurations without human interference ("humanless" technology), as a result of which the technical coefficient of machine use $K_{t.i}$ increases noticeably;[2]

the fourth (based on the YeS computer and enterprise ASU) controls planning and system material and technical supply (MTO), which makes possible the automated reconfiguring of equipment and automated conversion to the processing of another type of component. Thus, batches of components may be produced in the sequence and quantity necessary for assembly, and the value of uncompleted production is minimal, $K_{t.i}$=max.

Necessary conditions for the design and reliable, effective operations of flexible production systems are:

the use of group technology with careful analysis of manufactured products' technological design specifications, suitability for batch production, precision involved in their processing, the quantity of unfinished production, and smoothness of operation in flexible production systems;

a high level of effectiveness in production entities and production discipline. Here, the use of indices showing the adaptation of a product to the manufacturing process in a flexible production system is essential in evaluating effectiveness;

the use of machinery and equipment with a high level of intelligent numerical control (ChPU), high reliability, and delivery in full of the product with a range of loading and feeding devices;

integration of control systems with text- and speech-oriented programming enhancability;

the use of industrial robots and manipulators with a high level of adaptivity that use microprocessor technology based on integrated assemblies and standardized components to be used in generalized manufacturing involving interbranch cooperation;

the amalgamation of SAPR, ASTPP, ASUTP and GPS into an integrated, closed system by means of ASUP;

the development of a qualitatively new structure for production control systems, where a shop produces parts that are ready for assembly (without having to finish them), certified as to production, transportation and standardized documentation;

the formation of a new classification structure for industrial production personnel, their numbers, the determination of the social conditions of their labor for continuous operation of equipment;

training of qualified personnel capable of managing flexible production systems, from managers to service personnel for auxiliary production.

Experience in the development and implementation of industrial robots has been acquired, particularly in the area of instrument-building.

Figure 2 shows an enlarged diagram of the organizational interaction of a flexible production system in a machine shop with ASU for one of the enterprises, an automated design bureau (AKB) and head product engineer's office (OGT). All of the flexible production system structural units interface with each other by means of linking facilities (interface systems) and are covered by an integral control process performed by an integrated ASU.

Practically all machine-building and other branches are engaged in the development of flexible production systems. Often this leads to unexcusable parallel efforts, duplication of developments, a lack of necessary design standardization, and a low technical level.

The effectiveness of this work could be significantly increased by creating a specialized center for robot-building and the manufacture of equipment for flexible production systems, a subbranch that would take upon itself all the basic functions of development and production of automated equipment ordered by the other branches of machine-building,[3] centralized maintenance, and service.

Flexible production systems, that is, mobile manufacturing "networks", require a completely new level of production management and organization.

A high level should be reached by creating a new management structure for production as a whole (association or factory) as well as for each of its components (shop, production bay, production subdivision, technical services for material-technical and financial support).

For this, the following must be achieved:

the necessary operational reliability of flexible production system components, an integrated maintenance system along the lines of "AvtoVAZtekhobsluzhivaniye", as well as management of repair and preventative maintenance;

The creation of development personnel, production engineers and workers to operate SAPR, ASTPP, flexible production systems, and other systems included in an integrated production system;

the organization of integrated services for information processing within the enterprise, in order to provide synchronized and reliable operation of the SAPR-ASTPP-GPS system;

Схема 2

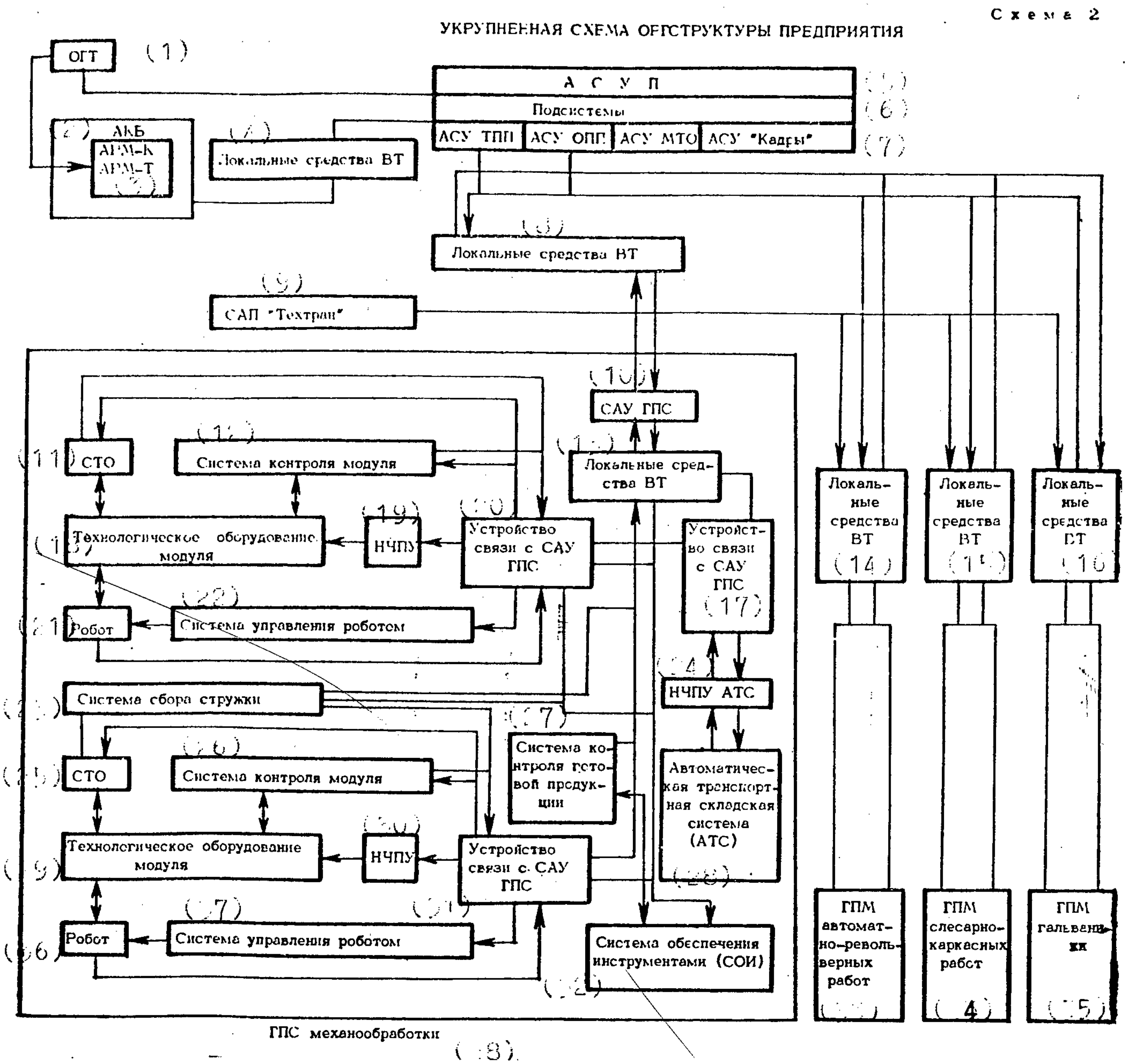

Figure 2. Enlarged Enterprise Organizational Structure Diagram

Key:

(1) Department of head product engineer (OGT)
(2) Automated design bureau (AKB)
(3) Automated work station for designer
Automated work station for product engineer
(4) Local computer facilities
(5) Automated management system for enterprises (ASUP)
(6) Subsystems

[key continued on following page]

(7) Automated control system for production engineering (ASU TPP)
Automated control system for operational production planning (ASU OPP)
Automated control system for material and technical supply (ASU MTO)
Automated control system for personnel
(8) Local computer facilities
(9) "Tekhtran" CAD system (SAP)
(10) System for automated control of flexible production systems (SAU GPS)
(11) Technical support station (STO)
(12) Module control system
(13) Local computer facilities
(14) Local computer facilities
(15) Local computer facilities
(16) Local computer facilities
(17) Communication device linking to system for automated control of flexible production systems (SAU GPS)
(18) Module hardware
(19) Numerical control equipment (NChPU)
(20) Communication device linking to system for automated control of flexible production systems (SAU GPS)
(21) Robot
(22) Robot control system
(23) Waste collection system
(24) Numerical control equipment for automated transport storage system (NChPU ATS)
(25) Technical support station (STO)
(26) Module control system
(27) System for finished product testing
(28) Automated transport storage system (ATS)
(29) Module hardware
(30) Numerical control equipment
(31) Communication device linking to system for automated control of flexible production systems (SAU GPS)
(32) Instrument support system (SOI)
(33) Flexible production module (GPM) for automatic lathe operations
(34) Flexible production module (GPM) for casing metal work operations
(35) Flexible production (GPM) for galvanization
(36) Robot
(37) Robot control system
(38) Flexible production system for machining

optimization of design in flexible production systems at all design stages; from the formation of rational manufacturing groupings of parts, to the cutting, instrument's trajectory of movement, and others.

In addition, it is essential to create a new structure and compliment of industrial production personnel, since here the key workers become operators of various flexible production system components (equipment, robots, transportation facilities, storage facilities or a complete flexible production system module), whereas the tasks of auxiliary workers will include the support of non-stop equipment operation and providing essential instruments and equipment when called for. Figure 3 shows the flexible production system conceptual structure.

Схема 3

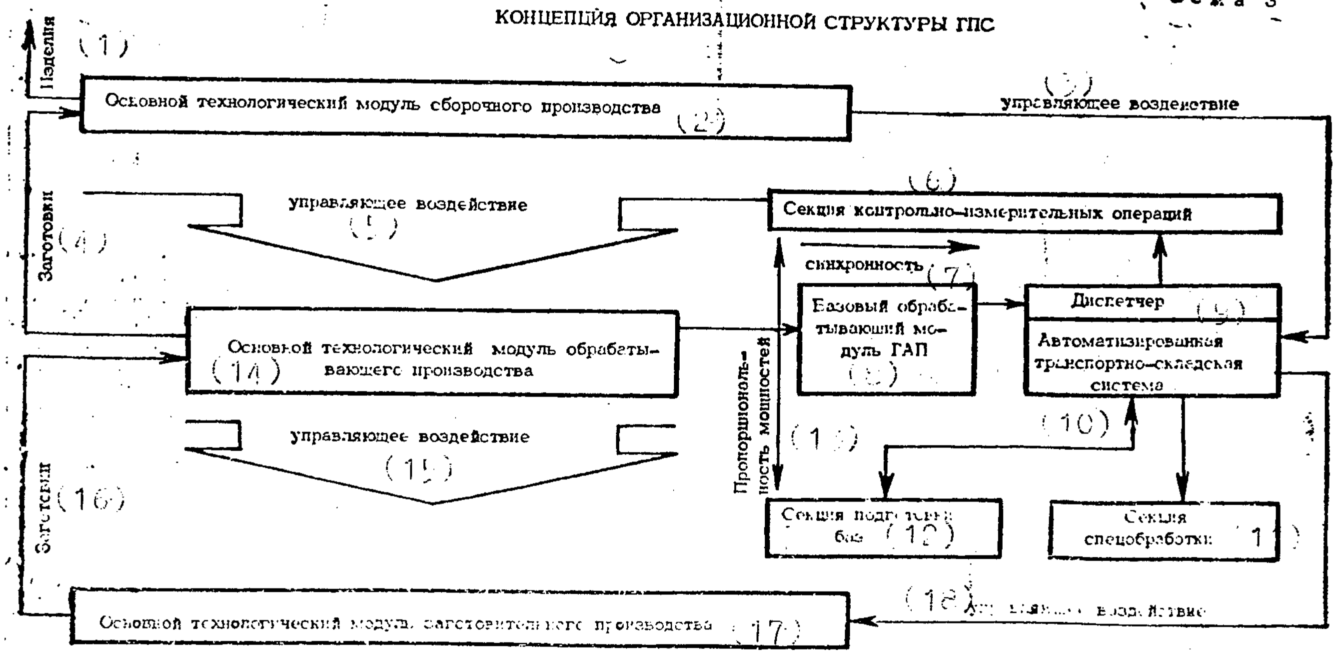

Figure 3. Conception of Flexible Production System Organizational Structure

Key:

(1) Finished product
(2) Main hardware module for assembly
(3) Control
(4) Intermediate product
(5) Control
(6) Testing and measurement stage
(7) Synchronization
(8) Base processing module for head design architect (GAP)
(9) Supervisor
(10) Automated transport storage system
(11) Special processing stage
(12) Base Tool-up stage
(13) Proportionality of capacity
(14) Main hardware module for production processing
(15) Control
(16) Intermediate product
(17) Main hardware module for intermediate production processing
(18) Control

The organization of present-day production, management system structure, planning, finance, price-setting, cost-accounting, the social-psychological structure and others should be regarded as links in an integrated, organically interrelated system resulting in a higher level system for instrument, mechanical, energy and transport service to support production, the organization of labor, management of quality control, accounting, labor incentives and quota-setting, and the training and retraining of personnel.

These questions are very important, because the implementation of flexible production systems is sometimes delayed not by the lack of a scientific base, but by a technical and organizational unpreparedness for automation of the entities to be controlled, for the selection of these entities, and consequently for the allocation of capital to these entities so as to achieve a maximum economic effect.

Areas for the future development of systems of technical standards documentation supporting work on the creation and implementation of flexible production systems is closely tied to the technology of these efforts and flexible production system components.[4]

It is essential to plan the development of technical standards documentation on the questions of the organization of production, labor, and management for the flexible production systems being created, as well as to revamp existing flexible production systems to suit conditions of integrated automation of all operational phases, from design to product manufacturing, for which the following must be done:

develop state standards encompassing all enterprises and scientific production association (NPO) activity environments involving flexible production systems;

develop standard designs for automated work stations for workers, engineers (ITR), and office workers; develop standardized organizational structures for administrative management involving flexible production systems at the automation and production-type levels; review management standards involving integrated automation, the characteristics of mixed service personnel teams for flexible production systems, and professional standards for the new workers' professions and responsibilities of engineers and office workers who will be engaged in development, implementation and operations;

review workers' professional listings and classifications, as well as the responsibilities for engineers and office workers, on the basis of trial flexible production system implementation. These documents should include the new workers' professions and responsibilities of engineers and office workers working with flexible production systems, as well as review procedures for creating organizational structure in flexible production systems and the system of compensation for personnel.

Technical standards documentation on procedures for developing flexible production systems should regulate the organizational needs of participating specialized enterprises that carry out contract work, as well as expertise provided for project engineering and the creation of standardized design.

The standards defining the essence of technical assignments should reflect the demands made on flexible production systems, their components, the time needed to develop the entire system and its components, and the order of system development.

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12713/9716
CSO: 1863/21

UDC 69.003:658.152.012.2

MAJOR DESIGN DECISIONS CONCERNING CREATION OF INTEGRATED PLANNING SYSTEM FOR CAPITAL CONSTRUCTION

Moscow PEREDOVOY OPYT V STROITELSTVE SERIYA 1 AVTOMATIZIROVANNYYE SISTEMY UPRAVLENIYA V STROITELSTVE in Russian No 4, Oct 84 pp 3-13

[Article by G. Kopilovich, Main Information Computing Center for the USSR Ministry of the Construction Industry]

[Abstract] Decree No. 6 of the USSR Gosplan, 11 January 1982, calls for the creation of an Integrated Capital Construction Plan System (YeSPKS). The system is to take in all stages in setting up the fixed capital and production capacities as well as all of the participants in the investment process. The YeSPKS of the Construction Ministry consists of blocks implementing sets of tasks in the individual areas of the planning activity: the sections of the comprehensive plan. The YeSPKS is to be incorporated in the ASPR [Automated System for Planning Calculations in Gosplan] and changes the configuration of the interaction of ASPR blocks when generating the plan assignments. The contents of the planning procedures for the determination of the values of the economic indicators of construction organization activity has been changed. The YeSPKS provides for improved plan decision making with subsequent computer-aided calculations of the plan indicators and automated issuance of documentation. The YeSPKS provides the capability of generating each planning indicator and section in an interactive mode. Charts illustrating the relevant organizational structures are shown: 1) Flowchart of the basic structure of the YeSPKS; 2) A tree chart showing the goals and criteria for plan situation analysis; 3) Process flow chart for the generation of routine operating plans in the YeSPKS; 4) The interrelationship of optimality criteria when drafting plans. The first stage of the YeSPKS system is planned to go on line at the beginning of 1986. Among the program modules shown are ADABAS and Natural, running under TSO. Figures 6.
[35-8225]

UDC 69.05:658.512.4

SOLUTION OF PROBLEMS RELATED TO IMPROVING ENGINEERING PREPARATION FOR CONSTRUCTION, COMPREHENSIVE OPERATIONAL SUPPORT FOR CONSTRUCTION INDUSTRY AND ORGANIZATION OF PILOT CONSTRUCTION PROJECTS AT THE SCIENTIFIC RESEARCH INSTITUTE OF THE CONSTRUCTION INDUSTRY

Moscow PEREDOVOY OPYT V STROITELSTVE SERIYA 1 AVTOMATIZIROVANNYYE SISTEMY UPRAVLENIYA V STROITELSTVE in Russian No 4, Oct 84 pp 18-21

[Article by B. Magid, Candidate of Technical Sciences, Scientific Research Institute of the Construction Industry]

[Abstract] The Scientific Research Institute for the Construction Industry has developed a draft of the topical plan for scientific, engineering and prototype design work for 1986-1990 to be included in the key "Nauka" program of the USSR Ministry of the Construction Industry in line with the plan for the development of a comprehensive program to improve the organizational and technical quality of construction in this ministry. It is planned that the efforts of the research institute in the section devoted to "Construction Organization and Management" will be concentrated on questions of improving engineering preparation and calendar planning for construction work, comprehensive operational support for the construction industry as well as operational management of the construction of large industrial complexes. This outline of the research program indicates that improvements in efficiency at all management levels will be attained through reliance on YeS computer systems. The implementation of these plans for the 12th Five-Year Plan at this institute should save 3.3 million rubles annually and eliminate 272 jobs. The 12th Five-Year Plan will see further implementation of plant technical management automation systems in reinforced concrete products and large panel plants for housing construction. More detailed information is available from the Scientific Research Institute of the Construction Industry, 440064, Ufa, No 3 Ulitsa Konstitutsii.
[35-8225]

UDC [002.53:681.3.016]:548

POSSIBILITY OF CREATING UNIFIED CRYSTALLOGRAPHIC DATA SYSTEM

Moscow NAUCHNO-TEKHNICHESKAYA INFORMATSIYA SERIYA 1 ORGANIZATSIYA I METODIKA INFORMATSIONNOY RABOTY in Russian No 9, Sep 85 (manuscript received 28 Dec 83) pp 17-22

[Article by N.I. Litvinchuk, N.N. Kochanova, E.A. Gilinskaya and L.A. Shevyakova]

[Abstract] The following crystallographic data banks are now on line or under development in the USSR: 1) The automated radiography information computer system for inorganic substances and materials (ARIS), developed by the Special

Technological and Design Office of the UkSSR Academy of Sciences Institute of Problems of Materials Science; 2) The radiographic data bank for in-plant phase analysis (BRD), developed by the "Burevestnik" Leningrad Scientific Production Association; 3) The data bank for chemical materials within the framework of the "Khiminform" information retrieval system developed by the All-Union Scientific Research Institute for Technical Information of the USSR Academy of Sciences and the Central Information Institute of the GDR Chemical Industry; 4) The data bank for the crystalline structures of inorganic compounds, developed by the Institute of Inorganic Chemistry, Siberian Department, USSR Academy of Sciences; 5) The automated phase analysis system (FAZAN) developed by Moscow State University. A detailed description of the configuration and contents of each system is followed by a recommendation that they be integrated using YeS computer hardware and software. Problems of computer system compatibility in such an integrated system have either been solved or present no technical difficulties. References 6: 4 Russian, 1 East German, 1 Western.
[33-8225]

UDC 657.2:63

EXPAND USE OF AUTOMATED TABULAR ACCOUNTING FORM

Moscow PLANIROVANIYE I UCHET V SELSKOKHOZYAYSTVENNYKH PREDPRIYATITAKH in Russian No 8, Aug 85 pp 28-32

[Article by M. Z. Pizengol'ts, Head, Accounting Department, Voronezh Agricultural Institute, Professor, Doctor of Economic Sciences]

[Abstract] The use of automated tabular accounting forms instead of tabular punch cards for agricultural accounting purposes is analyzed. In automated tabular accounting, the primary accounting data are entered on machine media by inputting the information to be processed to the computer, thus forming the working data files for subsequent machine processing. The use of first- and second-level codes for automated tabular accounting is described. The first group is made up of codes for special specific nomenclatures and specific data items, while the second is made up of general-purpose codes for the most important key specific data items. In order to speed up the implementation of automated tabular accounting, it is recommended that centralized national classifiers be developed for the nomenclatures that serve all branches in common. In addition, agricultural enterprises must be supplied with highly qualified accountants, and more academic attention must be devoted to the automated tabular accounting form.
[22-6900]

UDC 681.5:656

GROUP ALPHANUMERIC DATA INPUT TERMINAL

Moscow PRIBORY, SREDSTVA AVTOMATIZATSII I SISTEMY UPRAVLENIYA: AVTOMATIZATSIYA UPRAVLENIYA TRANSPORTNO-ZAGOTOVITELNYMI RABOTAMI V RAPO in Russian No 14, 1985 (signed to press 23 Jul 85) pp 7-9

[Article by Yu.N. Raspopov, V.I. Pismichenko, N.D. Gnezdyukov, and A.V. Krasnoborodko]

[Abstract] Large volumes of primary data must be processed in regional agricultural production associations. The large machine time requirements for data input reduce microcomputer efficiency, so the Krasnodar Branch of the All-Union Scientific Research Institute of Organization and Management Problems developed a group input terminal for alphanumeric data using the Iskra-226 program-controlled keyboard computer and five VTA 2000-2 video terminals. This configuration enables combining the shared access function with the preliminary data processing by setting up four additional work stations. The interface is a standard Iskra 015-82. The minimum transmitted data block is 1 byte and the maximum is 1,920 bytes; the maximum transmit channel loading time with the data from one terminal is 0.5 sec; the average output time for the prepared data from all five terminals to floppy disk storage is 12 sec. The group data input terminal system passed trial operation in the Kanevskiy rayon of the Krasnodar kray in service with the project: "Operational Accounting and monitoring of regional agricultural production association enterprises during the sugar beet harvesting and shipping".
[38-8225]

UDC 681.5:656

SOFTWARE FOR DATA PREPARATION TERMINAL BASED ON ISKRA-226 PROGRAM-CONTROLLED KEYBOARD COMPUTER

Moscow PRIBORY, SREDSTVA AVTOMATIZATSII I SISTEMY UPRAVLENIYA: AVTOMATIZATSIYA UPRAVLENIYA TRANSPORTNO-ZAGOTOVITELNYMI RABOTAMI V RAPO in Russian No 14, 1985 (signed to press 23 Jul 85) pp 10-11

[Article by Ye.V. Lutsenko, and N. D. Gnezdyukov]

[Abstract] Hardware and software for a data preparation terminal based on the Iskra-226 program-controlled keyboard computer and three VTA 2000-2 video terminals have been developed in the Krasnodar Branch of the All-Union Scientific Research Institute of Problems of Organization and Management. The software is written in BASIC 02 as an adaptive data processing system for the user. The data preparation terminal feeds in and corrects data from the Iskra-226 and the three video terminals, outputs forms to two floppy disk stores and provides for the printout of the forms. The terminal is controlled by the Iskra-226 operator in an interactive mode through the terminal

monitor using the keyboard. The data input is run in parallel from the keyboard computer and the three VTA 2000-2 video terminals, or from the video terminals alone. The user terminal unit has five functional program modules: the terminal monitor, the computer editor, the receiver of data from the VTA 2000-2 terminals, a module for monitoring soft transmit failures and a key for accessing the data base as well as a unit for data output to disk storage and a printer. The system passed the trial operating period in the Kanevskiy regional agricultural production association of the Krasnodar kray as the system for the project: "Operational accounting and monitoring of the work of regional agricultural production association enterprises during the procurement period". The use of the system has quadrupled the productivity of the data preparation process, while increasing hardware costs by only 50%. The time required for handling large data files has been reduced by a factor of 3. Operator overloading during the peak data input period has also been eliminated.
[38-8225]

HIERARCHICAL SYSTEMS FOR RECOGNITION OF HANDWRITTEN NUMBERS

Kishinev IZVESTIYA AKADEMII NAUK MOLDAVSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH I MATEMATICHESKIKH NAUK in Russian No 3, May-Aug 85 (manuscript received 25 May 83) pp 12-17

[Article by F. V. Frolov, and V.G. Gutsu]

[Abstract] While the problem of recognizing numerical characters is readily solved for stylized and machine written numbers by using reference standard images and filtering out attributes containing little information and noise, the recognition of handwritten symbols encounters the problem of the infinite diversity of styles (written forms) of the same class. The occurrence of anomalous forms makes it impossible to execute the standard comparison operations at times. This paper resolves the difficulty by developing a hierarchical analysis and identification of script numerals based on the syntactic analysis of the image information. Two mutually related matrices are used to describe an image, a metric information matrix and a matrix for the set of regions of singular points. This approach has the advantage that decision concerning a character can be made independently of the metric information, i.e. based on the characteristics of the singular point regions. A detailed description is provided for the ranking algorithm used to categorize the sequence of significant formats of the input image. An expression is also given defining the amount of information participating in the decision-making based on the two-level decision making rule. Figures 3; references 6: 4 Russian, 2 Western in Russian translation.
[4-8225]

UDC 371.694:621.311.25

ORGANIZATION OF COMPUTATIONAL PROCESS AND IMPLEMENTATION OF TRAINERS BASED ON MODELS OF ACTIVITY

Kiev GIBRIDNYYE VYCHISLITELNYYE MASHINY I KOMPLEKSY in Russian 1985 No 8 (signed to press 12 Feb 85) (manuscript received 10 Oct 83) pp 32-35

[Article by V. D. Samoylov and S.I. Smetana, Institute of Problems of Simulation in Power Engineering, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] An operational switching programmable trainer in which the computational process is based on a model of dispatcher activity is described. The trainer, which is designed for use with operational personnel in the power industry, is implemented on SM-4 minicomputers. The software supporting the various subsystems of the system is described. Because the computational process is based on models of dispatcher activity, it is possible to reduce the amount of random access memory required, and to allow for all of the features and constraints of specific circuits when performing operational switching. The possibility of using the same computer to implement other trainers by using the appropriate software is discussed. Figures 2, references: 5 Russian, 1 Western.
[27-6900]

UDC 681.327.2

STRUCTURE OF CONSOLE TOMOGRAM PROCESSING SYSTEM

Kiev GIBRIDNYYE VYCHISLITELNYYE MASHINY K KOMPLEKSY in Russian 1985, No 8, (signed to press 12 Feb 85) (manuscript received 28 Jan 83) pp 72-76

[Article by M. V. Sin'kov, I.P. Narizhnyy, V. V. Popkov, and S.M. Matveyev, Institute of Problems of Simulation in Power Engineering, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] A system is described for displaying and processing half-tone information and for displaying and editing alphanumeric information based on a storage tube for an X-ray computer tomograph. The required functional capabilities of the console tomograph system are enumerated. A functional diagram of the system, which satisfies the specified requirements, is presented and analyzed. Because of the use of storage CRTs, no memory is needed to regenerate images, so that the data transmission equipment can be slower and less expensive than memory-type displays for image regeneration. On the other hand, it is difficult to use storage CRTs to display dynamic processes, and the contrast provided is not sufficient. Figures 1, references: 4 Russian, 1 Western.
[27-6900]

UDC 681.3.066

PROBLEMS OF CONSTRUCTION OF SOFTWARE FOR SIMULATION SYSTEMS

Kiev GIBRIDNYYE VYCHISLITELNYYE MASHINY I KOMPLEKSY in Russian No 8, 1985 (signed to press 12 Feb 85) (manuscript received 19 Sep 83) pp 77-82

[Article by I. I. Petrov, V. N. Skorik, and A. I. Yatsunov, Institute of Simulation Problems in Power Engineering, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] This study investigates an approach to the construction of software for problem-oriented computer systems designed for solving problems in mathematical physics. The system incorporates a computer, the simulation subsystem, and an input-output device. The various levels of software used to create the necessary applications program, and also to obtain the next higher level of software, are classified and explained. The interaction among the components of the computer system is described, as is the operation of the supervisor that controls those procedures. The organization of the operating system and resident monitor are explained. Figures 6, references: 1 Russian.
[27-6900]

UDC 518.5

STATISTICAL MODELING OF CALCULATION OF PARAMETERS OF ELECTROCHEMICAL SHIP CORROSION PROTECTION

Kiev GIBRIDNYYE VYCHISLITELNYYE MASHINY I KOMPLEKSY in Russian No 8, 1985 (signed to press 12 Feb 85) (manuscript received 31 Aug 83) pp 100-104

[Article by T. I. Bilan, Institute of Simulation Problems in Power Engineering, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] An algorithm based on the Monte Carlo method is described for finding the stationary electrical field potential and determining the parameters of electrochemical ship conversion protection. The Monte Carlo method does not permit external problems to be solved directly, but makes it easy to implement the method of boundary condition variation. A three-electrode galvanic system is calculated as an example. The numerical findings obtained were within 2% of the analytical solution. The approach is assumed experimentally to be effective for calculating stationary fields in non-boundary regions; the closer the potential is calculated to the electrodes, the better the accuracy. Figures 2, references: 12 Russian.
[27-6900]

THEORETICAL FOUNDATIONS AND METHODS OF CONSTRUCTION OF UKRAINIAN SSR REPUBLIC AUTOMATED MANAGEMENT SYSTEM FOR SCIENTIFIC AND ENGINEERING DEVELOPMENT

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 3, Jul-Sep 85, (manuscript received 15 Mar 85) pp 9-13

[Article by V. Ya. Ruban, Candidate of Engineering Sciences]

[Abstract] This study describes the conceptual, simulation, and technological program levels of representation and implementation of a methodology that has been developed to support the creation of the Ukrainian SSR RASUNT (Republic Automated Management System for Scientific and Engineering Development), which represents a hierarchical integrated automated management system characterized by a large degree of indeterminacy and loose structuring of the development of science and engineering as an object of control. The RASUNT is defined as an automated system used for integrated modeling of the status of development of science and engineering. By accenting the modeling of the functions of the RASUNT, the system can be aimed toward automating management itself, as well as improving the entire system of indicators of scientific and engineering development by modeling fundamental systems properties. The realization of the proposed concept, methods, and technology enhance integrated automation of the management of scientific and engineering development by increasing significantly the number of sections in the system (from 2 in the first phase to 33 in the second), reducing the work required to create the second phase of this system by 700 man-years as compared with projections, and reducing the cost of obtaining the final product by approximately 2 million rubles. References: 2 Russian.
[15-6900]

EXPERIENCE IN IMPLEMENTATION OF SUBSYSTEMS OF UKRAINIAN SSR ACADEMY OF SCIENCES AUTOMATED DATA PROCESSING SYSTEM WITHIN FRAMEWORK OF REPUBLIC AUTOMATIC MANAGEMENT SYSTEM FOR SCIENTIFIC AND ENGINEERING DEVELOPMENT

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 3, Jul-Sep 85 (manuscript received 15 Mar 85) pp 41-43

[Article by A. F. Tutov, Candidate of Engineering Sciences, Ye. P. Tsapko, and V. M. Omel'chenko]

[Abstract] This study describes the implementation of two of the fundamental subsystems of the Ukrainian SSR Academy of Sciences Automated Data Processing System, the function of which is to acquire, store and process information pertaining to entities of the Republic Academy of Sciences for the apparatus of the Presidium of the Academy of Sciences. The "Scientific Personnel" subsystem is intended to create and maintain data bases and automate the storage of accounting data for use in personnel planning; the second subsystem--"themes and plans"--supports on-line analysis and processing of information to provide the Presidium of the Ukrainian SSR Academy of Sciences with data on the status of scientific research projects under way at various Academy

institutions. The structure of the hardware and software of the data processing system supported by these subsystems is described. Figures 2.
[15-6900]

MODELING OF COMPUTATIONAL LOADS OF UKRAINIAN SSR REPUBLIC AUTOMATED MANAGEMENT SYSTEM FOR SCIENTIFIC AND ENGINEERING DEVELOPMENT ON MULTIMACHINE COMPUTER COMPLEX OF THE REPUBLIC NETWORK OF COMPUTER CENTER

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 3, Jul-Sep 85, (manuscript received 18 Mar 85) pp 52-53

[Article by V. P. Vinnitskiy, T. G. Drogal', Candidates of Engineering Sciences, and A. S. Bushnev]

[Abstract] This study describes modeling of the organizational and functional parts of the requirements imposed by the Ukrainian SSR Republic Automated Management System for Scientific and Engineering Development (RASUNT) on multimachine computer complexes and data transmission systems, indicating the amount of working load and the structure of the information streams. The principles by which the organizational and functional parts are constructed are outlined; the data for modeling the structure of the multimachine computer complex are represented by an alternative graph; the way in which the elements of the functional structure space of the RASUNT units are distributed among the vertices of the graph serve as the initial data for synthesizing and structure of the republic computer center network. Figures 1, references: 3 Russian.
[15-6900]

TECHNOLOGY FOR INTERACTION OF SECTIONS OF UKRAINIAN SSR REPUBLIC AUTOMATED MANAGEMENT SYSTEM FOR SCIENTIFIC AND ENGINEERING DEVELOPMENT

Kiev MEKHANIZATSIYA I AVTOMATIZATSIYA UPRAVLENIYA in Russian No 3, Jul-Sep 85 (manuscript received 7 Mar 85) pp 17-20

[Article by T. G. Drogal', Candidate of Engineering Sciences, V. F. Kleshchevnikov, and A. I. Barvinskiy]

[Abstract] This study analyzes the integration of the sections, and the design of the facilitating machine technologies, of the Ukrainian SSR Republic Automated Management System for Scientific and Engineering Development (RASUNT). The stages which any interaction scheme must incorporate are described. Three alternative interaction schemes are presented and analyzed. The use of "banking" technology, with heterogeneous data bases distributed among the sections and interacting via the republic data transmission network, is found to be superior in that it provides useful results during system development, as well as routine operation. Figures 1.
[15-6900]

UDC 681.518.5

SELECTION OF CLASS OF AUTOMATED SYSTEM STRUCTURES FOR EXPERIMENTAL RESEARCH IN SONAR OCEANOLOGY

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 3, May-Jun 85 (manuscript received 11 May 84, after revision 9 Nov 84) pp 37-44

[Article by A. I. Yermachenko]

[Abstract] Since automated experimentation systems (ASEI) for sonar oceanology are designed for installation on research vessels or in shore test facilities no larger than 100 to 150 m overall, any ASEI must be configured as a local computer network. Requirements placed on two classes of such data processing systems incorporated in these local networks are summarized. Specifications are given for: the analog/digital conversion accuracy, the data input rate, the number of parallel and series input channels, the processing time requirements for real time and near-real time modes, etc. Quite detailed requirements are listed for the requisite performance (operations/sec) and memory capacities. A typical example of a microcomputer-based local network with remote crates using CAMAC processor is shown and discussed. The following standards can be used for interfacing the mini- and microcomputers to the instrumentation hardware: CAMAC, EUR-6500, COMPEX, MEK-625-1 and Multibase-2, since they have the most hardware and software support in the USSR. Sixteen-bit microcomputers are used and fiber optic lines of less than 150 meters are used for connections to remote crates. Use of specialized processing and machine processors is mentioned. The configuration of an advanced system feasible in the near future is also shown. Figures 5, references: 7 Russian.
[391-8225]

UDC 621.12.014.5

EVALUATION OF PARAMETERS FOR MODEL OF SHIP CONTROL ABILITY ACCORDING TO COURSE ANGLE

Kiev MODELIROVANIYA SLOZHNYKH PROTSESSOV I SISTEM in Russian 1985 (signed to press 14 Dec 84) pp 153-155

[Article by L.L. Barushchenko and Yu.N. Suyazov, appears in collection under rubric: Academy of Sciences of the UkSSR, Institute of Problems of Modeling in Energetics]

[Abstract] The parameters for a linear model of the steering of a ship according to the course angle are the inertial time constant (TC) and the coefficient of effectiveness (CE) of the rudder which are determined for undisturbed conditions. However these values do not apply for course angle stabilization mode because rudder adjustments do not coincide with the stabilization mode and nonlinear factors affect the ship. A method is

presented for determining the parameters under conditions approximating stabilization mode. As initial conditions, it is supposed that there is no high-frequency component in the ship deviation angle and the deviation from course is a low-frequency component which can be considered as the sum of the angular deviations due to control and random low-frequency course deviations. The random deviations have a linear trend and expressions are developed for the control deviations. Supposing that control mode time and effectiveness parameters are known, then the difference between the observed values for deviation angles and the real ones will be equal to white noise with zero probability and a maximum likelihood method is used with simplifications which are explained in order to determine the required values of the TC and CE parameters. References: 2 Russian.
[399-12497]

UDC 681.3.01.84

APPLICATION PROGRAM PACKAGE FOR COMPUTER-AIDED DESIGN OF VIBRATION-PROTECTION SYSTEMS

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85 (manuscript received 25 Jan 84) pp 97-99

[Article by Ye.L. Karpukhin and A. D. Mizhidon, Irkutsk Computer Center of the USSR Academy of Sciences Siberian Department]

[Abstract] Vibration protection problems for instrumentation were analyzed into standard design tasks and a program package was developed which in dialogue or batch mode allows a designer to determine the characteristics of the instrument, decide if vibration protection is necessary and then specify the necessary protection, evaluate limiting parameters and select suitable serially-produced materials with correct parameters. Designers without specialized programming training can use the package since the system is relatively high-level and a simplified natural Russian language is used for interaction. The required memory is not large and the package can be expanded by users knowing FORTRAN. The package can be used with YeS computers with OS YeS. The hardware configuration involves 256K of main storage, YeS 5061 or YeS 5050 magnetic discs, a YeS 7920 terminal, an input unit for punched cards, and an alpha-numeric printer. References: 5 Russian, 1 Western.
[344-12497]

UDC 681.3

DIALOGUE SYSTEM FOR AUTOMATED INPUT, PROCESSING AND OUPUT OF EXPERIMENTAL DATA BY COMPLEX OF TWO BESM-6 COMPUTERS

Moscow PRIBORY I TEKHNIKA EKSPERIMENTA in Russian No 2, Mar-Apr 85 (manuscript received 5 Oct 83) pp 65-69

[Article by Yu.N. Belyayev, Yu.P. Gorlov, S. V. Makarychev, A.A. Monakhov and S.A. Shcherbakov, Institute of Mechanics, Moscow State University]

[Abstract] A system was developed for carrying out experimental research with the Shar unit on hydrodynamic stability and turbulence in rotating spherical layers involving the continuous collection and processing of data over long periods by computers operating in real time and multiprogram mode with a reduction in computer efficiency of less than 5% due to the rate of data flow. The system consists of a complex of two BESM-6 computers linked to the experimental unit. They have digital output and graphic facilities. The programming in FORTRAN consists of procedures for data recording, dialogue interchange between the experimental unit and the computers and a program package for processing results. The experimental data consisting of measurements of speed distributions, pressures and temperatures of the layers and the speeds of rotation of the boundaries are collected in 5-7 hour sessions and passed through a 10-bit analog/digital converter (ATsPK-100-11/2) with a maximum rate of $13 \cdot 10^3$ conversions/s after the filtering out of ultralow and ultrahigh frequencies. A 70m cable connects the conversion unit to the computer input. The computer has a subsystem for real time data storage and has continuous reception capacity using the DISPAK operating system and computer memory for the resident part of the program which with nonresident programs control a buffer data input and transcription on tapes and discs. The data collection rate is $2.5 \cdot 10^3$ readings/s. A program package handles data processing, results are printed out and a small quantity of data can be sent back to the experimental equipment by teletype or perforated tape. Control of processing from terminals is implemented by a special dialogue procedure using a code for telegraph channels and MADLEN language for question and answer exchanges with unlimited possibilities for introducing new commands and functions. Data passes through an interface with digital/analog conversion and is output by a graphic device. An example is shown of the transcription of an energy spectrum for flow speed pulsations showing peaks which are 7-8 orders of magnitude higher than industrial and hydrodynamic noise and these results could not be obtained for the experiment by analog methods. References: 1 Russian, 1 Western.
[387-12497]

UDC 519.687.5

OPTIMIZATION OF CONTROL DETERMINATION IN FULL-SCALE SIMULATORS

Kiev MODELIROVANIYE SLOZHNYKH PROTSESSOV I SISTEM in Russian 1985 (signed to press 14 Dec 84) pp 156-161

[Article by I. Ye. Yefimov and I. A. Ryabinina in a collection under the rubric: Academy of Sciences of the UkSSR, Institute of Problems of Modeling in Energetics]

[Abstract] The quasi-analog modeling of dynamic systems by full-scale simulators with real time computer processing involves complex problem formulation and procedure development. An algorithm is discussed for computer procedures controlling full-scale simulator performance whose real object is described by ordinary differential equations. The problem formulation involves a similarity operator whose physical meaning is the coincidence of the simulator coordinates with those of the modelled object. The algorithm consists of two main parts, firstly, the computation of the coordinates of the modeled object and, secondly, computation of the control actions necessary to satisfy the similarity criterion. In both cases various methods are used involving repeated steps and approximations and for each discrete control step a set of procedures is executed for both parts of the algorithm. Because of the repeated computation steps in real time whose periodization does not always coincide with the discrete system steps an optimization criterion is formulated for the simulator computations which must take into account many factors including the required precision and the type of simulator. The particular case of a flight simulator is considered and it is supposed that the dynamic equations for the flight simulator can be treated as linear and can be approximated. An algorithmic treatment is given which produces graphically represented results from which optimal variants are selected. References: 3 Russian.
[399-12497]

UDC 681.52

MODELING OF CONFLICTING DESIGN SITUATIONS AND DECISION-MAKING BY VECTOR GAME METHODS

Kiev MODELIROVANIYE SLOZHNYKH PROTSESSOV I SISTEM in Russian 1985 (signed to press 14 Dec 84) pp 221-230

[Article by V.I. Garbarchuk in collection under rubric: Academy of Sciences of UkSSR, Institute of Problems of Modeling in Energetics]

[Abstract] The development of complex systems such as for power or atomic energy projects, machine or ship building or aviation design involving hazards are considered as functions of degree of risk, which include factors such as probabilities of accident, design imperfections, technical errors

and uncertainties concerning operation, while these characteristics are themselves complex functions of many variables. Vector models and methods are proposed for these problems leading to decisions for minimizing the degree of risk by modeling which considers the design of the system as a goal-oriented process or game in which there are interested parties or players consisting, in some cases, of the designer, client, manufacturer of pilot plant, tester, user and the environment (nature). There are various possible vector goals and strategies and a model is given for producing optimal design solutions. At various design stages the number of players increases and combinations of players are possible if their goals coincide. The environment can be considered as either a passive participant with unlimited resources or as an active player since its resources may be limited or it may have negative effects (energy and transport problems, etc.). The model is treated as a vector matrix game and a vector optimization procedure for the players can lead to a design solution. A decision method is presented based on the formulation of the degree of noncoincidence of goals which is the degree of antagonism among the players. Goals can be reduced at the risk of trivializing the game and the proposed decision method consists of the choice of reference point for minimax strategies of the players. Solution algorithms are given for this procedure and the design of an energy system is given as an example. References: 4 Russian, 1 Western.
[399-12497]

UDC 681.8.06/14

ANALYSIS OF CORRECTNESS OF CONTROL LOGIC ALGORITHMS USING MODEL OF CONTROL OBJECT

Kiev MODELIROVANIYE SLOZHNYKH PROTSESSOV I SISTEM in Russian 1985 (signed to press 14 Dec 84) pp 248-252

[Article by G.P. Koloskova and V.A. Koloskov in collection under rubric: UkSSR Academy of Sciences, Institute of Problems of Modeling in Energetics]

[Abstract] Control logic algorithms (ULA) and programs for discrete control units are usually tested on the basis of initial task requirement definitions and the degree of attainment of standard results but difficulties arise because the initial requirements are not sufficiently well defined for satisfactory algorithm design. Because of the errors in the algorithm, testing does not lead to the required improvement of programming and adequacy to the object. An improved method is proposed for designing tests based on the control object considered as a set of input/output sequences whose characteristics are accessible to the designer. This reduces the possible errors in the algorithm results and reduces the maximum number of necessary tests to within practical possibilities without hampering performance. The ULA is conceived as operating in a scheme consisting of a control unit interacting with a control object and there is a clock, an operator's console and peripherals which transmit data to the control unit input as to system states. The control unit realizing the ULA is an asynchronous Moore automoton.

Analysis of the scheme shows that testing can be limited to certain state sample set procedures without introducing errors. Test methods based on ULA do not detect whether the designer has left out a control procedure while the proposed method excludes the possibility of this. References: 3 Russian, 1 Western.
[399-12497]

UDC 621.37:519.21

MODELS AND CRITERIA FOR OPTICO-ELECTRONIC AND OPTICOMECHANICAL SPECIAL-PURPOSE SYSTEMS

Kiev MODELIROVANIYE SLOZHNYKH PROTSESSOV I SISTEMY in Russian (signed to press 14 Dec 84) pp 270-273

[Article by V.I. Dubas and P.P. Maslyanko in collection under rubric: UkSSR Academy of Sciences, Institute of Problems of Modeling in Energetics]

[Abstract] Reliability methods are considered for special-purpose optico-electronic and opticomechanical instrument systems which are subject to intensive vibration and overloading but are not reparable and lose their precision after a certain use period. The usual statistical methods for failure prediction based on full- or semi-scale experiments are not applicable because the instruments must always operate at a high level of precision whatever the stress and the design process must therefore allow for a high level of reliability by incorporating a safety factor. Special analytic methods are necessary for determining reliability indicators and the problem of evaluation has been approached through the establishment of a density distribution due to two random variables (robustness and stress) but this does not take into account the aging of the instrument. Another formulation involves a random process in which the safety factor is limited by two determined or random time factors forming an acceptable region outside of which failure occurs. With this model various reliability criteria are possible such as immediate failure at the boundary of the region, worsening of function or failure dependent upon the stay in the forbidden area, but the computations are very complex. A concept treating the external stress as a Markov process simplifies evaluation and the process affecting the system can be considered a stationary random process with a normal distribution and spectral density which can be approximated by a rational function although further generalization for variable boundaries for the acceptable operating area is necessary. A program package was developed for computerized computation of the reliability of special-purpose instrumentation. References: 9 Russian.
[399-12497]

UDC 681.324

ORGANIZATION OF INTERCOMPUTER EXCHANGES IN REAL TIME DISTRIBUTED COMPUTER COMPLEX

Kiev UPRAVLYAYUSHCHIYE SISTEMY I MASHINY in Russian No 3, May-Jun 85 (manuscript received 15 Nov 84) pp 51-54

[Article by A.A. Morozov, V.I. V'yun, A.F. Zubets (deceased) and S.N. Sakharov, SKBMMS, Institute of Cybernetics, Ukrainian Academy of Sciences, Kiev]

[Abstract] Large-scale complex automated control systems for industrial objects involving distributed computer complexes for data processing must solve problems concerning real time data exchange between computers. The solution consisting of global networks or minicomputer exchanges is rejected because the advantages of local computers (short time lags, high throughput, simple protocols) are lost. A multiport switching system is proposed for computer interchange with a modular and branching structure. For reliability there should be two independent routes between any two computers and a topology is proposed which has the possibility of "incomplete" links such that if two computers are not directly linked they can communicate through temporary transit modules. In order to attain the required transmission speed synchronous parallel data transmission is used. A description is given of the switching modules for temporary links (number determined by number of clients) and of transmission protocols and message forms. The architecture allows defective connections to be replaced by other paths. Data flow is regulated by an agreement process in which the sender computer informs the receiver of the transmission volume and the channel is dynamically adjusted. References: 5 Western.
[344-12497]

UDC 621.391

PRINCIPLES OF ADAPTIVE CONTROL OF NETWORK FOR TRANSMISSION AND DISTRIBUTION OF INFORMATION FLOWS

Kharkov AVTOMATIZIROVANNYYE SISTEMY UPRAVLENIYA I PRIBORY AVTOMATIKI VYPUSK 70 in Russian 1984 (signed to press 4 Sep 84) (manuscript received 24 Nov 82) pp 107-112

[Article by Ya. A. Fastovskiy]

[Abstract] Adaptive control of digital data transmission networks involve realization of an adaptive algorithm by adaptive switching nodes (UAK) regulating throughput of network branches in order to optimize load distribution and routing in view of the statistical indeterminancy of channel loading and the random possibilities of element failure. The network is considered to be a hierarchical structure consisting of levels of user nodes and adaptive switching nodes linked to the central processing unit and its interface block. Each level's adaptive node can be considered as decentralized while at the same time having a place in the hierarchy so that the architecture has the advantages of both centralized and decentralized organization. The throughput can be regulated depending upon loading at the current time and upon diagnostics of future loading. If the flow is light the best form of regulation is statistical routing in which distribution control is effected by each UAK. If there is overloading, client services must be limited by centralized priority or queuing methods. If loading is near critical then quasistatistical methods which are intermediate between centralized and decentralized are appropriate. Since the load varies continuously, control techniques must also be continuous, i.e., adaptive. A block diagram and vectorial analysis of the functional parameters of the system are given. The service algorithm consists of an evaluation of the UAK capacity, optimization of throughput capacity in terms of channel and packet switching and selection of the best plan for data flow. References: 7 Russian, 1 Western.
[404-12497]

UDC 681.324

LOCAL AREA COMPUTER NETWORKS IN INTEGRATED PRODUCTION COMPLEXES

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 4, Jul-Aug 85 (manuscript received 8 Feb 85 after revision), pp 54-60

[Article by A.N. Domaratskiy, V.V. Nikiforov, and V. M. Ponomarev]

[Abstract] This study analyzes the creation of local area networks and the development of the conceptual principles that define their basic capabilities, as well as the systems principles that dictate their basic structures. There is as yet no one ideal local area network that is capable of satisfying the numerous and often conflicting requirements of users. One specific

feature of local area networks employed in integrated production complexes is that they must incorporate no critical devices whose failure could affect the operating reliability or timing characteristics of the network: The network must function autonomously and independently of the operating systems and hardware of any particular working station or computer connected to the network. The types of network topologies in use are described. The use of physical and logical connections is explained. The use of bridges to interconnect local area networks is described. The structuring of local area network software is illustrated. Figures 4, references 8: 5 Russian, 3 Western.
[14-6900]

UDC 681.324

SM1800 MICROCOMPUTER LOCAL AREA NETWORK EQUIPMENT

Riga AVTOMATIKA I VYCHISLITELNAYA TEKHNIKA in Russian No 4, Jul-Aug 85 (manuscript received 30 Oct 84) pp 61-64

[Article by Kh. I. Martson and Ya. U. Mell']

[Abstract] The SM1800 microcomputer, which serves as an intelligent communications device used as a station in a multichannel network, is described. Each station incorporates the station interface module that is connected to the common serial data bus, which can consist of a coaxial or other two-conductor cable up to 3 km long. The ILPS2 serial line interface and its requirements are described. The dispatcher and station interface modules are special-purpose microcomputers based on the KR580IK80A microprocessor. Testing of the network dispatcher module and ILPS2 station interface module is described. Bit rates ranging from 31.25 to 1000 kbps are achieved, with a transmission distance over an ordinary pair of conductors of 1600 m at 125 kbps, and a maximum effective useful data rate of 17 kbps. Figures 1, references 5: 4 Russian, 1 Western.
[14-6900]

UDC 681.324

INFORMATION COMPUTER NETWORKS IN AUTOMATION SYSTEMS

Leningrad PRIKLADNYYE VOPROSY SOZDANIYA INFORMATSIONNO-VYCHISLITELNYKH SETEY in Russian 1984 pp 3-11

[Article by Yu.S. Vishnyakov, and V.M. Ponomarev]

[Abstract] The Leningrad Information Computer Network of the USSR Academy of Sciences, designed and developed by the Leningrad Scientific Research Computer Center (LNIVTs) of the USSR Academy of Sciences in conformity with the Akademset' network development program is used to illustrate the capabilities

and needs of computer networks, whether local or global. The Akademset' network includes the central computer complex and the data transmission terminals and channels installed in the Leningrad institutes of the Academy of Sciences. The network also includes a regional switching center for Akademset' channels run via telephone lines to similar centers in Moscow, Riga and Budapest. Provisions have been made for interfacing with the Interset' network now in the planning stage: the computer network of the academies of sciences of the socialist states. Local computer network architecture variants are discussed and the advantages and predominance of personal computers are noted. Experience acquired at the LNIVTs indicates that the design solutions adopted for such networks are correct and that the information computer network as a means of automating information processing is highly efficient. Figures 4.
[45-8225]

UDC 681.3.06

ORGANIZATION OF INTERACTIVE STRUCTURE FOR NATURAL SCIENCES RESEARCHER IN EXPERIMENTATION AUTOMATION SYSTEMS BASED ON LOCAL COMPUTER NETWORK

Leningrad PRIKLADNYYE VOPROSY SOZDANIYA INFORMATSIONNO-VYCHISLITELNYKH SETEY in Russian 1984 pp 57-70

[Article by O.V. Kostyayeva, and S. V. Surma]

[Abstract] This paper is a general discussion of the structural organization of user-friendly interactive systems based on microcomputers in automation systems of physiological experimentation within a local computer network. The primary user requirements for such an interactive system are: 1) The man-system interaction must be as simple as possible; 2) The interactive mode must be simple enough to preclude the need for supplemental instruction; 3) The language dictionary of the interactive system must be as close as possible to the terminology in the researcher's field; 4) The actions of the user must be treated unambiguously by the system; 5) Dialog must be accompanied by the requisite analysis of user actions so as to detect possible errors; 6) The interactive speed must be governed both by the conditions of the particular experiment and the psychological limitations of the user; 7) The interactive system must protect vitally important automation system centers against unauthorized access; 8) The dialog system structure must provide the requisite flexibility when the class of problems or the research topic is changed. Various general ways of meeting these requirements are discussed and illustrated with flow charts showing the scheme for the performance of physiological experiments and research as well as the hierarchical organization of user language instructions and the overall interactive system structure.
Figures 6; references: 2 Russian.
[45-8225]

UDC 007:061.2

SYSTEMS APPROACH TO CONSTRUCTION OF MODEL OF AUTOMATED SCIENTIFIC RESEARCH SYSTEM

Leningrad PRIKLADNYYE VOPROSY SOZDANIYA INFORMATSIONNO-VYCHISLITELNYKH SETEY in Russian 1984 pp 70-74

[Article by O.B. Perova]

[Abstract] The principles of systems research are applied to the analysis of an automated scientific research system consisting of the human researcher, the research field, the computer-aided experimentation control system and the system for the overall research automation. Diagrams are drawn showing the interrelationship of the aggregate of basic processes and creative processes subsumed under all processes characterizing the human activity in the research system, as well as showing the relationship of the research system to the environment. This general systems theory description is intended as the basis for the design of adaptable computer-controlled research systems. No specific examples or data are provided. Figures 3; references 6: 5 Russian, 1 Western.
[45-8225]

UDC 65.012.122

ON ONE DYNAMIC PROBLEM OF VOTING THEORY. II.

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 9, Sep 85 (manuscript received 12 Jul 84) pp 118-127

[Article by S.G. Novikov, Moscow]

[Abstract] Two players participate in a game, alternately selecting points in a Euclidean space from sequentially proposed programs; the selections are made so that the results of the voting is as close as possible to a fixed ideal of the player. An odd number of voters take part in the voting. Each voter has fixed ideals and votes for one program. Paper I [Novikov, S.G., AVTOMATIKA I TELEMEKHANIKA, 1985, No 8, pp 104-114] analyzed the "rough" configurations of the game field for which there exist neighborhoods of the ideals of the players and voters such that with any shifts of the ideals within the corresponding neighborhoods, the qualitative nature of the game trajectories does not change. The existence of final pairs (i.e. ultimate cycles of length 2) in these rough cases was demonstrated along with the existence of ranges of initial values tied to them which as an aggregate completely cover the Euclidean space. This paper studies the possible configurations of the set of all final pairs, their classification and the partitioning of the Euclidean space related to this, breaking it down into domains of initial points that reduce the trajectory to definite classes of final pairs. Theorems are given for the arrangement of the set of all final pairs in the space and the partitioning of the space is analyzed in some detail. The set of finite cycles to which the game trajectories converges is determined by the configuration of the ideal players and the voter. Appendices provide proofs of the two final pair theorems and examples of computer experiments. Figures 8, references: 2 Russian.
[31-8225]

UDC 681.325.65

CONDITIONS FOR TERMINATION OF MODELING OF FAULTY LOGIC NETWORKS

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 9, Sep 85 (manuscript received 12 Jun 84) pp 137-143

[Article by V.A. Yermilov, Kiev]

[Abstract] The simulation of faulty logic networks where competition is present always encounters the difficulty of determining when to stop the modeling. This paper employs a heuristic approach: Two sets of states A_f^0 and A_f^1 are present in some input sequence for each element f of a logic network. The former set includes states in which a signal c_f has a value of 0 and the latter contains states where c_f is 1. Any set of input signals to a network may generate only periodically repeating sequences of output signal values from the network elements or signals with constant values. Thus the sets A_f^0 and A_f^1 and the expressions describing them either vary periodically or remain constant. The periodically repeating signals assume indeterminate values during simulation, while the states in which such oscillations occur are included both in A_f^0 and A_f^1. This stabilizes the sets and signals; the modeling is terminated at this point. However, the sets are quite large for complex networks and in order to find their period, they must be stored as an aggregate for all of the network elements every time even just one of the sets changes. The requisite computations preclude this approach. Two theorems are stated and proved to circumvent this problem: 1) In logic networks with no delays in the feedback loops, the sets A_f^0 and A_f^1 are stabilized within a finite number of modeling steps; 2) In logic networks with delays in the feedback loops, there exist a number of modeling steps within which the sets of states also stabilize. Expressions are given for the termination values of A_f^0 and A_f^1. A sample simulation is shown for a network that can be in only one of two states where there are three input signal values and the delay in the feedback loop exceeds the transient process time from the initial input set to the final set. This sample illustration of theorem 2 indicates that only 25 steps are needed in this instance. Figures 1; references 2: 1 Russian, 1 Western.
[31-8225]

UDC 519.8:681.3:621.3.049.77

OPTIMAL ALGORITHMS FOR SOLVING PROBLEMS OF MUTUAL POSITIONING AND COVERING OF PLANE POLYGONAL FIGURES

Minsk VESTSI AKADEMII NAVUK BSSR: SERYYA FIZIKA MATEMATYCHNYKH NAVUK in Russian No 4, Jul-Aug 85 (manuscript received 6 Jul 82) pp 28-36

[Article by L.V. Nosov, Ye.G. Nosova, Ye.B. Rabinovich, and V.Z. Feynberg]

[Abstract] Computer-aided design and manufacturing of integrated circuits requires the solution of problems of the superpositioning of rectangles,

trapezoids and triangles on plane polygonal figures, the calculation of the areas involved and the determination of the requisite configurations. Two algorithms are constructed for such solutions in a time comparable to the sorting time. The optimality of the algorithms is proved. Graph theory is applied to five problems: 1) Construction of the cover of a polygonal figure using trapezoids and triangles so that any two figures of this cover have no common internal points; 2) Construction of the cover of a rectangular figure using rectangles so that any two rectangles have no common internal points; 3) Construction of a forest of trees T (determination of all of its edges); 4) Calculation of the area of a plane, polygonal figures; 5) Determination of whether there is in a set of polygons even one pair of nonintersecting polygons. These problems are solvable in a time of O(N log N), where N is the total number of boundary vertices for a given polygonal figure; O(N log N) is the lower bound of the time required in all cases. Figures 3, references 12: 7 Russian; 4 Western; 1 Western in Russian translation. [34-8225]

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